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PROFESSOR HENRY BALFOUR, F.R.S.

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PROFESSOR HENRY BALFOUR, F.R.S., who died on 9 February 1939, was born in 1863. He was educated at Charterhouse and Trinity College, Oxford, where he took an honours degree in animal morphology and rowed in his College boat. In 1884 General Pitt-Rivers gave his collection to the University of Oxford, and Professor Moseley was put in charge of what was called the Pitt-Rivers Museum. He asked Balfour, who was then twenty-one years old and had just taken his degree, to help in the arrangement and installation of the collection. Thus began his association with the Museum, which was to end only with his death fifty-five years later, first under Moseley, then under Sir Edward Tylor, and finally, from 1891, in sole charge. During all these years the collections continued to grow, so that now they must be several times the size of General Pitt-Rivers's original gift.

Balfour was an ideal museum man. His knowledge of his subject was vast; in fact, it is no exaggeration to say that he was the greatest authority on the material culture of primitive people in his day. He was singularly gifted for the position he held; a good classical scholar, his training as a zoologist had taught him to notice minute differences in specimens and given him an ability to classify which he applied to material culture.

An admirable draughtsman, he had an interest in all forms of art, and was one of the first to write on the origins of the designs of primitive peoples. The first paper he published was in 1888, on "Evolution of a characteristic pattern on shafts of arrows from the Solomon Islands," in the *Journal* of the Anthropological Institute. This was followed in 1890 by a paper on "The origin of decorative art as illustrated by the art of modern savages." In 1893 he published his excellent little book, long out of print, 'The evolution of decorative art: an essay upon its origin and development as illustrated by the art of modern races of mankind.' This profoundly influenced other anthropologists writing subsequently upon this subject. Other papers on primitive art were "Bird and human designs from the Solomon Islands," in *Man*, in 1905; and "The origin of stencilling in the Fiji Islands," published in the *Journal* of the Royal Anthropological Institute in 1924.

His interest in music and musical instruments can be seen in the number of

papers he wrote dealing with primitive musical instruments. In 1896 he published, in the *Reliquary and Illustrated Archaeologist*, "A primitive musical instrument, the whithorn." Three years later his small volume, 'The natural history of the musical bow,' which showed the great knowledge he possessed of musical instruments of all ages, was published by the Clarendon Press. Amongst other articles on the subject, he wrote the section dealing with musical instruments from the Malay Peninsula in 'Fasciculi Malayenses: anthropological and zoological results of an expedition to Perak and the Siamese Malay States, 1901–1902,' by Nelson Annandale and Herbert C. Robinson. He also wrote the section on music in *Notes and Queries on Anthropology*.

Balfour took a great interest in archery, and wrote several papers on bows. As early as 1889 he published one on "The structure and affinities of the composite bow" in the *Journal* of the Anthropological Institute. In 1897 he published some notes on "A remarkable ancient bow and arrows believed to be of Assyrian origin" (*J.A.I.*). In 1909, in the *Journal* of the African Society, appeared "The origin of West African cross-bows," in which he traced their origin to large cross-bows then still being used for harpooning whales in the southern portion of Store Sartor, a large island adjacent to the port of Bergen. In 1921 he gave the Huxley Memorial Lecture for the Royal Anthropological Institute, and chose as his subject "The archer's bow in the Homeric poems."

He wrote on many other subjects from time to time; such as fishing, fish-hooks, and fish-traps, primitive currency, fire-making, modern brass casting in West Africa, and on the "Tandu" industry in Northern Nigeria and its affinities elsewhere (*J.R.A.I.*, 1934). Tandu is a method of making containers for liquids, etc., out of layered membranes of animals moulded on a clay core which is subsequently broken out. It was known in ancient Egypt and is still used in South Africa and India, but its method of making in Nigeria was comparatively unknown.

Balfour was also a first-rate archaeologist. He was one of the few prehistorians who have experimented in making stone tools. The beautifully made little flint fish-hooks in the Pitt-Rivers Museum testify how proficient he was in the art. This gave him an understanding of the technique used by ancient man, which most prehistorians unfortunately lack. He visited many of the French caves and famous sites on the continent and, in 1905, collected palaeoliths at the Victoria Falls. While in Rhodesia he found amongst some ruins fragments of pottery engraved with flint after it had been fired, a form of ornamentation since recognized in many other parts of the world. He was the first to publish this method of decoration, the article appearing in *Man* in 1906, "Flint-engraved pottery from the ruins at Khami and Dhlo Dhlo, Rhodesia." He published papers on stone tools from various parts of the world: in 1892, on "Stone implements from the Malay Peninsula in the Pitt-Rivers Museum," in *Archaeologia Oxoniensis;* in 1912, on "Stone implements from Ejura, Ashanti," in the *Journal* of the African Society. His Presidential Address to the Prehistoric Society of East Anglia in 1925, "Status of the Tasmanians among the Stone Age peoples," threw a great deal of light on an imperfectly studied subject.

The width of his knowledge was the outcome of a scientific training, study and reading, a very retentive memory, many visits to other museums, and

also considerable travelling. In 1888, he spent two months in Finmarken and Russian Lapland, which introduced him to the Lapps, in whom he was always to take great interest. In July 1905 he went with Mrs. Balfour to South Africa for the British Association Meeting and afterwards to Rhodesia. He revisited South Africa in July 1907, and again in June 1910, when he gave a series of lectures in various towns for the South African Association for the Advancement of Science. In 1914 he was abroad from the end of June to the beginning of November, going to Australia with the British Association and returning by Java and the Malay States. In August 1922 he went to the Naga Hills in Assam, travelling between 200 and 300 miles chiefly on foot with J. H. Hutton and J. P. Mills. He made large ethnographical collections and returned in the following January. In 1927 he went up the Amazon. In the summer of 1928 he was for three months in Kenya and Uganda, visiting the Masai, Nandi, and other tribes. In 1929 he went again to South Africa with the British Association as President of Section H (Anthropology), his Presidential Address being "South Africa's contribution to prehistoric archaeology." In 1930 he went to Northern Nigeria, and in 1933 spent a month in Finland and Norway.

Professor Balfour joined our Society in 1908, and served on the Council for several years. Though he never read a paper, he frequently took part in discussions and contributed valuable reviews to the *Journal*, while his wide experience was always at the disposal of travellers and students. In 1936 he was elected President, an office for which he was admirably fitted, and applied himself to furthering in every possible way the interests of the Society, despite his bad health, which finally obliged him in 1938 to decline nomination for a third year. It was a source of great pride to him that he was able to represent the Society in Westminster Abbey at the Coronation. The Council have placed on record their deep appreciation of his long and devoted services to the Society.

Besides being President of our Society, he was President of the Anthropological Institute (1903–04), President of the Folk Lore Society, President of the Anthropological Section of the British Association for the Advancement of Science in 1904 and again in 1929. He was a Corresponding Member of various Anthropological Societies in Europe and America. He was a Fellow of Exeter College, Oxford, and was elected a Fellow of the Royal Society in 1924.

As a lecturer Balfour was at his best, and could inspire in his pupils some of his own enthusiasm. His influence remained after they had left Oxford, and many of those who went into the Indian and the Colonial Services made collections which enriched the Pitt-Rivers Museum.

He was the most lovable man, with a keen sense of humour, a great lover of dogs and all animals, and devoted to his garden, which was a real bird sanctuary. He was a very keen ornithologist, and edited with notes and preface F. M. Ogilvie's 'Field observations on British birds,' published in 1920. It is impossible to think of him without thinking of Mrs. Balfour, whom he married in 1887 and who died a few months before him. They were a most devoted couple, sharing all their interests in common, and their friends will recall with pleasure the celebration of their golden wedding in 1937.

L. C. G. C.

A JOURNEY IN DUTCH GUIANA

IVAN SANDERSON

Evening Meeting of the Society, 20 March 1939

THIS paper is the story of a year spent in Dutch Guiana upon a zoological expedition to collect specimens and data for the British Museum (Natural History). It is an account of a sojourn in, rather than an expedition to, the country, and was made possible by the sales of a popular book on the lighter aspects of a previous scientific expedition to the British Cameroons. We also owe a great deal to the Government of Suriname. From the Governor downwards we received such understanding and assistance as can seldom have fallen to the lot of any party of investigators in a foreign country. Through an unfortunate loss of mail, we arrived in the country unheralded and entirely unknown, with a large car and forty cases full of the most suspicious assortment of gear. We came from a small country with emigration laws that are known to be homely, to say the least, *via* ports where a bad form of smallpox was raging, without return tickets, and with exactly sufficient ready cash to pay landing deposits, which would not have been required if the mails had not gone astray with our official letters of introduction. Every official and department however did everything possible to assist us. The Dutch indeed appreciate very fully the scientific attitude. Nor is it to the Government alone that I want to express our heartfelt thanks, but also to all those business houses, traders, and craftsmen, whether Surinaamers or foreigners to the country, like ourselves, who unceasingly helped us through the many intricate problems which we had to tackle during the year that we spent in Suriname. In addition my thanks are due first to my wife, not only for the more than fair share of all the work which she undertook but more especially for her help in the endless and often tedious photographical work; secondly, to my assistant, Mr. F. G. Allsop, without whose unceasing patience, counsel, and practical help our work could never have been completed; and lastly to many friends at the British Museum whose advice was freely and unstintingly given, and who also arranged for us to receive some essential supplies.

Schedule and scope of the work

Our objects were really threefold. They were in effect: the planning and constructing of a permanent outfit of gear, or what we now term "total equipment," for the efficient prosecution of travels in tropical and temperate climes for the purposes outlined below; the testing of original field methods in comparison with established methods, with regard both to general living and to our special branch of scientific work, with this new permanent equipment as a basis; and a survey of the fauna of the country, with collections of certain groups.

Details of these three sets of investigations will be published elsewhere in the future. Further reference to these matters in the following account will be made only when their inclusion is essential to the continuity of the narrative.

Our party consisted of my wife, Mr. F. G. Allsop, myself, and two locally hired native lads. During the last three months moreover we were able to get along quite comfortably with only one native servant without any falling off in the work. This was partly necessitated by the exigencies of the country, but was also due to our desire to test in every respect the methods outlined above, which included the reduction of all personnel, especially native assistance, to an absolute minimum. Even had we not been testing such methods, the almost complete elimination of native labour and the reduction of any locally hired staff would have had to be accomplished in Suriname. Labour costs in this otherwise admirable place must be proportionately higher than in any other tropical country, and are in no way compensated by the quality of the labour itself, which is extremely low. There is much unemployment there, coupled with an extraordinary unwillingness to work consistently.

The first four months were spent in Paramaribo, the port of arrival and capital of the colony. We rented a comfortable house, where we constructed much of the equipment, and from which we made sallies into the surrounding countryside by road, to the coast by launch, and into the smaller creeks by canoe. In our opinion such a preliminary canter in a new country determines the success or failure of a collecting trip, as it affords unruffled opportunities for getting to know the people, learning a little of the language, the names and current prices of the animals, the general value of commodities, the geography of the country (with special reference to the distribution of the vegetation), and finally for training some staff and proving to the authorities that one's intentions are serious. We spent the next three months penetrating the jungle country up the great rivers. This was made possible by purchasing a motor launch, and resulted in our most valuable collections of animals, a really intimate knowledge of the country, and perhaps the most happy three months in my life. Three months were then devoted to an investigation of the savannah belt and its forest areas. The collections here were beyond our expectations. Lastly, we resided for two months on an abandoned gold-mine clearing in the high virgin forest, among the lowest foothills of the hinterland massif.

We had intended making one further extended expedition, in the true sense of the word, up to the headwaters of the Courantyne river on the western border of the country hard by British Guiana, but other business intervened and we returned to England instead. We had not expected to find anything novel above the Courantyne–Kabalebo confluence; Professor Stahel, of the Department of Agriculture, who had visited the locality, had stated that it was but a repetition of the Coppename area. It was the totally unexplored condition of the whole area that attracted us most, I believe, and we had laid our plans in the belief that we would have a few months free on the completion of our general work in the country. It was very disappointing that circumstances prevented our going there.

The reasons for the limited extent of our travels when once we were in the country may be of interest to future travellers. A tourist with five weeks at his disposal can visit Suriname and see the real virgin jungle, aboriginal Amerindian settlements, African tribal life, Malay dances and festivals,

Hindu temples, queer animals, Dutch canals, and gold mines in perfect comfort and at moderate cost. To get to the interior however is well-nigh impossible.

Foremost amongst the difficulties is the cost both of labour and of commodities generally. Unskilled labour is at a minimum rate of gulden 1.50 per day, or approximately 3*s* 5*d*. This may rise to gulden 3 per day or even higher for skilled paddlers entering the uncharted southern areas. In addition there is the cost of feeding this labour while away from inhabited territory. The cost of boats and canoes is low, but of most other goods very high. Comparing our expenditure in Suriname with that during a similar period in West Africa under similar conditions, but with twenty-five native staff instead of two as in Suriname, we find that in all columns but mail and freight and official charges the figures for Suriname are exactly double. Secondly, the country is entirely uninhabited but for those small coastal areas shown on the map (Fig. 1), the banks of some rivers up to the cataracts, and the remarkable pocket on the extreme south-east. There are no roads, paths, or tracks in the interior such as are found in practically all other equatorial forest countries. Similarly, as there are no native settlements, there is no natural food supply, local labour, guides, or purveyors of such bush essentials. This involves the transport of everything necessary for the whole trip, including food for one's labourers as well. Since travel includes path-cutting and canoe-building as well as porterage, this labour must in any case be excessive. Thirdly, it is quite impossible to live off the country or even rely upon augmenting one's larder by the chase or by gathering edible plants, for the animal life is extremely hard to come by, there is hardly any big game and no edible vegetable products. There is often no water, especially during the dry season, when even the low country is very sparsely supplied with running streams. Fourthly, all idea of paddling into the country in canoes has to be abandoned, for all the rivers are cut by cataracts about 100 miles inland, necessitating extensive path-cutting, porterage, and, in the case of a trip to the high land, the burning of one's canoes to prevent the retreat of one's labour, and consequently the refashioning of new boats from standing timber on the other side of the watershed.

Estimating forty loads of equipment (a conservative minimum) for the prosecution of one's living and work in the interior during a period that would make a trip worth while, one needs a further forty carriers for food. Their food in turn has to be carried, necessitating still more carriers. The total cost of labour at gulden 1.50–3 per day for so many months plus the price of food, equipment, canoes, etc., becomes astronomical.

One of Suriname's present difficulties is a stream of enthusiastic "explorers" who descend upon the country, many of them ostensibly to search for the flier Paul Redfern, who was lost somewhere in South America between Curaçao and the mouth of the La Plata several years ago. Such parties arrive without any knowledge of conditions in the country and often with insufficient funds. This is extremely aggravating to the local authorities, who have to extricate them from their difficulties, and expensive to government departments. Also it makes the path very rough for serious workers.

General geography

Suriname lies on the north coast of South America between lat. 2° and 6° N., long. 54° and 58° W., and consists of a section of the northern slope of the Guiana massif, which in turn lies between the great valleys of the Amazon and

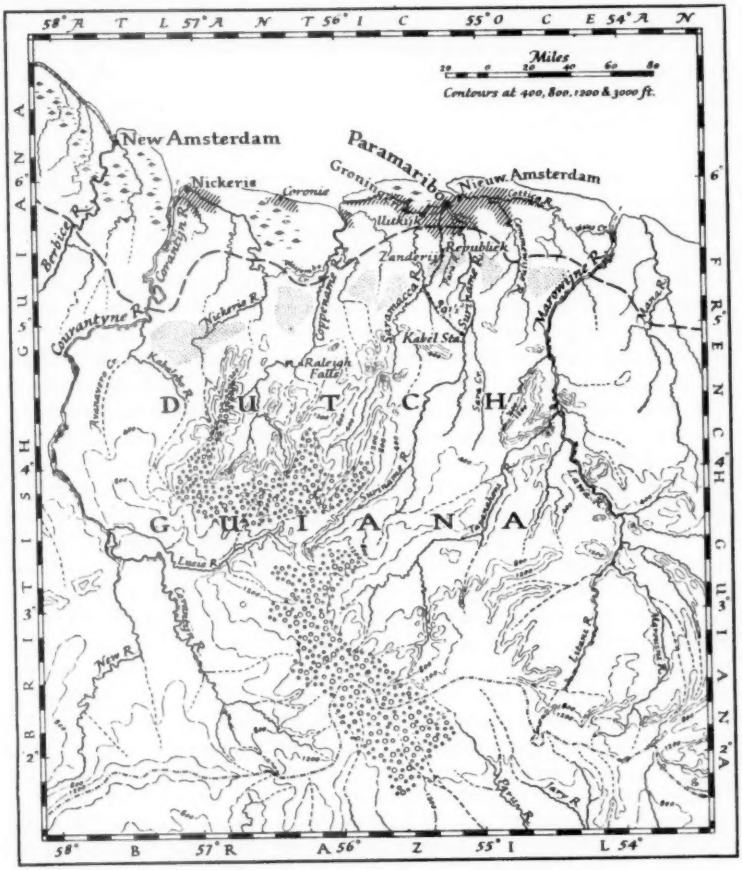


Fig. 1. Dutch Guiana

the Orinoco. This massif is considered by some to be the terminus of a great arm of the Andes which curls round to the east from a point east of the pinnacle of Ecuador, but there is distinct zoological evidence against this view. The Guianas are, in fact, a natural province.

Suriname was sighted by Columbus in 1498. The Spaniards seem to have

neglected it altogether, but a British expedition arrived in 1595 and the first Dutch in 1598. The first permanent settlements in the Guianas were established by the French, Dutch, and English in 1613. These were only small trading-posts. That section of Dutch Guiana bounded by the Coppename and Marowijne rivers was chartered by Charles II of England in 1663 and given to Lord Willoughby and Lawrence Hyde. This they administered until 1667, when it was exchanged with the Dutch for New York. Dutch Guiana did not assume its present form as a colony until 1833. The name of the colony was said to be derived from the names of the first English Governor, the Earl of Surrey, and that of his country seat at Ham in England. It appears however to be of local origin.[1]

The colony as now defined is bounded on the north by the Atlantic, on the west by British Guiana, on the east by French Guiana, and is backed on the south by Brazil. Its geography is simple.

The political boundaries form a square to which a smart hit appears to have been administered from the French side, resulting in a corresponding bulge on the British side. The whole country is high at the back, or south, and descends gradually to the sea, which it eventually weds rather than meets, and under which it continues gently to descend. The highlands in the interior and upon the southern border rise into various ridges, low ranges, and peaks, the highest recorded being 3257 feet in the Wilhelmina range.

There seems to be considerable doubt about these ranges so clearly marked upon most maps both of the country and of South America in general, for fliers report that there is no sign of many of them. A word of warning may here be given concerning the several maps of South America that have recently been produced. In these it is not sufficiently explained that most data appertaining to the heavily forested equatorial areas are mainly conjectural. This is very noticeable in Suriname, where we found the Coppename river at one point to be nearly 20 miles away from its position as defined by the map which we were using[2]; at another point there were about 50 per cent. more right-angled bends.

There are four great river systems in the country, all running roughly south to north. The first is that of the Courantyne, which rises some 290 miles inland behind the mountains, and forms the boundary between British Guiana and Suriname. The mouth of this river is "qualified" by that of the Nickerie river. The second is the Coppename, the mouth of which is qualified by the Saramacca, as is the third, the Suriname river, by the Commewijne. The last is the Marowijne, which is as long as the Courantyne, and forms the boundary with French Guiana. It is again qualified by the Mana river in that country. Each river is thus double, the lesser affluent in each case curving round until it runs parallel to the sea in a westerly direction. Nor is it in this respect alone that such remarkable uniformity of plan is to be seen, for each affluent in each system owns but one major tributary, always on the east, and each follows the same major bends.

The whole country may be divided into four major regions, lying in great belts parallel to the coast. First there is the upland mountainous region at

[1] C. van Coll, in *Bijd. Taal-, Land- en Volkenk. Ned.-Indië* 1 (1903) 507.
[2] Carte internationale du monde, 1 : 1,000,000: Amer. Geogr. Soc.

the back, then a wide belt of foothills and low rolling country, then a wide continental plain, and finally by the coast an equally wide marine plain. The continental plain is formed from the denudation of the uplands, the marine from coastal submarine deposition. It is essential to keep this grouping in mind, for it explains the distribution of flora, fauna, population, and even the mineral wealth of the country.

Our work was mainly zoological, and in the new light in which we are trying to prosecute field work in this sphere the distribution of floral types or vegetational zones is of the utmost importance. As it was impossible to reach the hinterland where the mountains are covered in true Moss or Mist forest[1] we concentrated upon the remaining three major topographical zones. These are simple to deal with in outline, being composed of four great belts depending upon the topography and soil groups of the country. The foothills and continental plain are both clothed in tall rain forest, the marine plain in flood forest, and the junction of the two is marked by a string of lakes of damp savannah. Lastly the sea is bordered by a wide belt of mangroves which extends to as far as 30 miles up some of the larger rivers and on to the marine plain. Within these major vegetational zones there are some exceptional areas marked by predominance of certain plants or plant types, due to altitude, excessive aridity or moisture, or absence of soil or human agency, but they are in the aggregate very limited for the size of the country. The savannahs themselves may be regarded merely as exceptional areas within the rain forest due to surface beds of pure felspathic sand, and the mangroves as due to excessive salinity. The country might therefore be described as uniformly clothed in tall rain forest, varying from mixed dicotyledons inland to almost pure *mora* forest with many palms by the coast, where it is almost perpetually flooded.

The alteration of the natural vegetation due to human agency in Suriname is very slight. The cleared lands, now about 20 per cent. cultivated, consist of a small area radiating from Paramaribo to the east, south, and west for about 35 miles, and of two minute areas round Coronie and Nickerie. Apart from these there are only infinitesimal "ponds" near the bush-negro villages along some of the rivers, due to shifting cultivation.

Paramaribo and environs

We arrived in Paramaribo on 10 January 1938, having come from Haiti *via* Curaçao and the Venezuelan ports. The magnificent contrast between luxuriant tropical growth, Dutch cleanliness, and European dignity met here and the aridity, West Indian grubbiness, and Western vulgarity that we had left was more than simply pleasing. We disembarked at sundown. The impression that we had gained of the town during the four hours of laborious approach up the shallow muddy river had been that of a rather beautiful little Dutch burgh with small white-faced houses, old red pent roofs, and gentle spires nestling behind an orderly waterfront with modest and far from unsightly wharves. The brief drive through the town in no way dispelled this impression, while our first intimate contacts with it the next day very greatly augmented our notions of its charm.

[1] See *Geogr. J.* 69 (1927) 185; 70 (1927) 90.

As in the East Indies, the Hollander in Suriname has reproduced the neat orderliness of his homeland. Wide tarmac or sand streets lined with regular stately royal palms are flanked by friendly white-fronted houses. Everywhere there are polden or little canals with sluice gates under old brick doorways with tiled roofs. There are public gardens and park-like areas filled with flowers. The Residency of the Governor stands in full view behind a low clipped hedge opposite the homely Palace Hotel. The few mellow brick buildings, beautiful in their simplicity, are all constructed of bricks brought from Holland about a hundred years ago. Even the meaner streets are devoid

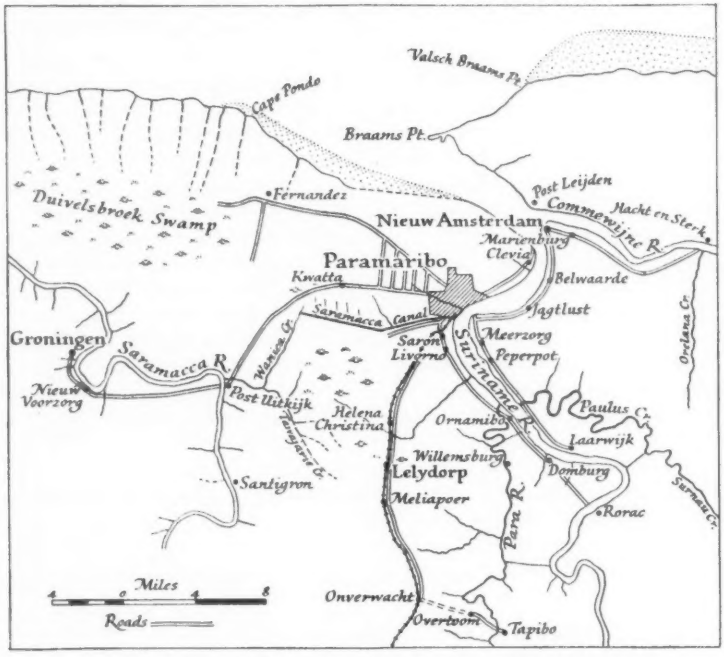


Fig. 2. Paramaribo and region, showing motorable roads

of rubbish, and the main river front as well as all the tidal creeks, which are gruesomely muddy, are devoid of the customary tin cans and other human detritus. The government offices, police stations, and other official places are spotlessly clean, while even the smallest shops are tidy and neat. This is more than a compliment to the Hollanders, for visits to the back-yards of the dwellings of the general populace show that the majority of the inhabitants—not so much the real Surinaamers, who are very fastidious—are prone to the West Indian hoarding instinct, slovenliness, and indifference to accumulated rubbish and dirt.

We were but three days in the hotel, and then moved into an extremely charming house, fully furnished and supplied with a happy, efficient staff.

All this, as well as necessary formalities to make use of the car we had brought with us, the entry of all our gear through the customs, and countless other favours, had been most smoothly accomplished with the help of officialdom, and especially of Mr. W. Smit, of the Department of Finance, whose friendship was private as well as official. The car (a 1925 Rolls-Royce) was saved from a rusty grave in Haiti at a price of £10, and subsequently proved its worth a thousandfold in that country, where it transported three of us and close on a ton of equipment to the remotest parts, over what are probably the worst roads in the world, and sometimes to an altitude of 8000 feet. The excellent service it rendered, coupled with the fact that its maintenance cost proved to be almost non-existent, prompted us to take it to Suriname, where there are few roads. It materially assisted our work there, cut down our expenses considerably, and also added greatly to our pleasure.

We had come to the country for the three purposes outlined above. The foundations of two of them—the general collection of the fauna and the construction of permanent equipment—were laid at this house. It happened that in addition to rendering us every assistance asked, all our new acquaintances, both official and private, were also good enough to spread the word that we desired to purchase live examples of the fauna. The inhabitants of Paramaribo are far from lacking in knowledge of the natural history of their country. They also relish the turning of an honest but easy penny, and the town is infested with captive wild animals of all kinds, accumulated through the constant clearing of land by the farmers who bring their produce into the town markets. Within twenty-four hours of our establishment in the house a stream of eager sellers descended upon us. The fauna of Suriname is perhaps more varied and unusual than that of any other country, not only in proportion to its size but even in general. Our enthusiasm and interest thus became a difficulty rather than an asset, for several entirely new types of animals arrived every day, none of which we could persuade ourselves to forgo. They varied in size from full-grown pumas and large deer to bats, frogs, and mice, and they all had to be housed. This problem was only surmounted by energetic carpentry, often into the small hours of the night. The Rolls dashed about the town gathering packing-cases, timber, wire-netting, cratefuls of bananas, and endless parcels of nails, screws, hinges, etc. No sooner had we converted a case into half a dozen cages with carefully fitting doors, perches, and drinking-cups, suitable for rabbit-sized creatures, than a man would turn up with an outsized cat or a basket full of tiny agile lizards capable of squeezing through even quite perfect amateur carpenter's joints. At one time we had no less than 172 live animals at the house. A full account of building pens round giant anteaters because we couldn't move them, of a capybara wandering off into the town and being brought back by members of the garrison, and of an opossum wrecking the whole of our neighbour's drainage system, and other episodes would fill a book. We accumulated a most valuable collection of the commoner animals, together with countless parasites from them, and much original data on their food, habits, and reactions to certain physico-psychological experiments.

The other part of our work was equally interesting and of equally lasting value. We planned the whole of the permanent mobile equipment and built

the fitted cases for nearly half of it. Their contents were selected and purchased in the excellently stocked stores of Messrs. C. Kersten and Company, who practically never failed us, and whose courtesy and assistance deserve more praise and thanks than I can ever hope to express. By the end of our stay in Paramaribo itself our equipment, from having started as an ill-assorted mass of items mostly impractical, badly packed, and often quite useless for the purposes for which we required them, had assumed dimensions and quality which enabled us to leave for an extended trip to a completely bush area with a staff of two and easy consciences. At this juncture only the loads essential to travel and work in the jungle under canvas were completed. The sorting of the remainder of the equipment was accomplished during the latter part of the year. Here I would like to record a note of thanks to my colleague, Fred Allsop, who made with his own hands the bulk of the complicated cases with all their fittings of lidded trays, compartments, and other devices, and also gave me much help in the designing of them, which was no simple task, because not only size but also weight maximum, shape, and contents had to be constantly borne in mind, not to mention the irksome task of measuring and fitting into some cases as many as seventy different items of all sizes, shapes, and fragility.

This period in Paramaribo was also extended by much other work which need not be specified. A skinner and male cook were trained to our requirements, maps were verified by conversations with people who had travelled in the country, the prices of animals ascertained, and so forth. We also made many trips into the surrounding country by car. There are five major roads radiating from Paramaribo on the western bank of the Suriname river, two on the eastern, which is reached by a car ferry (Fig. 2). One road to the Saramacca river at Uitkijke is continued beyond to Groningen lower down that river. The other roads are of very limited extent. Nevertheless we were able to accomplish a considerable amount of collecting on the cultivated, cleared, and overgrown cleared land (or tertiary growth and secondary forest).

In the days of slavery there used to be very extensive, well-managed, and profitable estates covering large areas round Paramaribo and growing sugar-cane for rum and molasses, coffee, maize, and other tropical products. The abandonment of slave labour ruined the estates, so that now most of them have fallen into decay, the families that owned them have become small Boer farmers or moved into the town, and the shade trees have coalesced to form great belts of secondary forest with a riot of tangled vegetation below. The polden have silted up or dried out, and many areas have reverted to shallow flood forest once more. The more recent settlement of indentured labour upon smallholdings has resulted in an entirely different landscape over wide areas. Here the country is very like that of England at first glance. There are neat fields of short lush grass in which cattle graze, others dotted with horses or sheep. There are ricefields looking like our own cornfields, little copses, small thatched cottages with immaculate little flower-gardens, barns ornamented with roosters, duck-ponds with ducks, muddy lanes with geese, and farmyards with ferocious dogs. In the distance there is always a rampart of forest however, and here and there a solitary giant tree like a great oak that has had its trunk stretched. Closer inspection of course shows incongruities

such as farmers' wives in saris, palm trees, weaver birds' nests, humps on the shoulders of the cattle, and a tropical surfeit of goats. Nevertheless, when driving back to town in the cool beauty of a pastel sunset the illusion of driving through Sussex may become almost overpowering.

The country itself is dead flat, without a trace of a stone. The soils are very uniform, being nothing more than delta silts and muds partially dried out and now exceedingly rich. Throughout this marine delta plain, which extends right along the country by the sea and is about 30 miles wide, there occur winding beds of sand, lenticular in transverse section and actually composed solely of finely divided fragments of countless marine shells.

The inhabitants of Suriname

There is probably no other place in the world where large bodies of so many racial and sub-racial types live side by side, and even intimately intermingled with one another, as in Suriname. These inhabitants are so diverse in their variety that they warrant special mention.

The Caucasics include the true Hollanders, mostly higher officials or business men connected with the colonial aspect of the country. Few are permanently resident. With them may be associated an almost equal number of other Europeans, or, speaking more strictly, Caucasics of the European branch, including quite a number of English and Americans. There is a very considerable community of old-established Jewish families and many Syrians, to both of whom much of the trade and prosperity of the colony, not only since the abandonment of slavery, but even in the old estate-owning days, is due. There is also a very large population of British Indians. After the emancipation of the slaves large numbers of British Indians, both Hindu and Muhammadans from more northern territories, were brought to the country as indentured labour. The British Government later, through arrangement with the Dutch, brought this movement to an end. On the completion of their contracts these families were offered a choice of smallholdings in Suriname or repatriation, and many elected to remain. Round Paramaribo the country is practically an Indian colony, and the Indians make very fine farmers.

The Negroes probably predominate in the colony, and in Suriname there have been three major negroid penetrations, each bringing a culture at a different stage of development.

The townspeople originally appear to be descended from Africans brought to the country as slaves. They are now, as elsewhere in Central America, the backbone of the social structure, and may be defined as those who are distinguished by their European dress and cosmopolitan social behaviour. Then there are the so-called "British Negroes," who are sometimes confusingly referred to as "First-time-people," which in point of fact they are not. These migrated from the British possessions in Central America to combat a labour shortage at the end of the last century, and brought with them the culture which had already crystallized in those countries. Their womenfolk may, at the present day, be recognized by their picturesque costume.

The last and by far the most interesting group of negroid peoples are the Jukas or "Boschnegers" (bush negroes). Here we meet a unique nation with

an entirely separate political organization and culture, which has been admirably described by the Herskovits.[1] They reproduce exactly a West African tribal organization, which they brought over from that country complete in every detail. The point that is of particular interest about the Jukas is the reason for their origin, which does not appear to have been sufficiently stressed. Any one who has visited West Africa will know that it is senseless to talk of bands of slave-traders descending upon that coast and rounding up tribesmen for export: the locals only had to "go to bush." The true procedure was for the slave-trader to find an African chief who had a surfeit of slaves, and to offer him a profitable price for them. Thus were the majority of America's slaves obtained. Towards the end of the slave days however the African supply began to lag and Arabs, scurrilous African chiefs, and white men together contrived to grab a certain number of African free men to make up their deliveries. As soon as these free men were landed in the new world they walked off into the bush. These proud and competent tribesmen were the original Jukas, and they reproduced the organization of life in their home country along the banks of the great rivers in the interior of Suriname.

Next, mention must be made of the Mongolian peoples of the country. The first group is the Amerindians, the original indigenes of the country. They are now few in number and unevenly distributed. It appears that the coastal plains were the territory of Carib stocks, of which the few remaining villages, now for the most part of "so-so-Indian" or mixed negro Indian content, belong to a tribal group known as the Kalina-Galibi. A recent boundary commission and expedition to the south-east came across Amerindians of another tribal group along the rivers at the headwaters of the Marowijne. In addition to these however an entirely different tribe or set of tribes was found in the recesses of the forest in this low-lying plain, to investigate which a Dutch expedition is now in the field. These people are extremely light-skinned and are probably therefore the origin of the everlasting "white Indian" story current throughout the Guianas. Their existence was previously unsuspected, even the river Indians of the district making no mention of them. Their state of development is so primitive as to be only at the beginning of the cultivating, and for the most part still in the collecting stage. They do not even clear land for plantations, but await the fall of a forest tree before planting scanty beds of their one crop, a herb whose identity will doubtless be determined by the expedition at present in the field. One girl from this tribe, a mysteriously beautiful though remarkably alert and practical creature, has arrived in Paramaribo after several years' personal experience that would cap any expedition by a European to a primitive tribe. Madame Stahel has made a study of her language and acted as guardian over her. It appears that her people are not only completely unaware of the existence of Paramaribo and of white men, but have never even suspected the presence of negroes over the mountains, and only know of a salt sea through some of the dimmer passages in their mythology. It is almost incredible to be brought face to face in these days with a complete, primitive unit of humanity not 200 miles from a coast settled by Europeans for several centuries.

[1] M. J. and F. S. Herskovits, 'Rebel destiny: among the Bush Negroes of Dutch Guiana.' New York and London, 1934.

High tide at the coast *A. V. S.*

Beached whale on the mud-flats at low tide *A. V. S.*

Ribbon creeper in the rain forest *A. V. S.*

The Para river *A. V. S.*

Ribbon creeper in the rain forest

The Para river

The second division of the Mongolian race is represented by a not inconsiderable number of Chinese, who prosecute a very large bulk of the business in those trades to which they always gravitate. In addition several of the higher professions are to some degree in their exceedingly capable hands. Thirdly, there have been introduced into Suriname since the termination of coolie emigration very large numbers of Malays, mostly from Java. These delightful little people are mostly resident upon the estates, but are also being offered smallholdings as an alternative to repatriation, and large numbers are availing themselves of the opportunity. They retain their traditional dress, complete with sarongs and batik turbans.

In concluding these remarks upon the human inhabitants of this country, I would like to mention the Surinaamers. I make special mention of them because they are elusive of definition and perhaps even themselves unaware of their separate identity. Politically they are Dutchmen, but they inherit much that the Hollander cannot. They are the colonial residents, descendants of the fine families who owned and still often do own the estates, in whose hands is the government and much of the business of the country, but who are now as much an intrinsic part of the country as anything in it. They are the new nation, extremely charming and cultured, the heirs to the colony, in whose veins courses a blood more cosmopolitan than perhaps any other in the world, and often containing a little of all the previously mentioned groups, in which fact resides their greatest guarantee of the future of their country.

The coast

While we were living in Paramaribo we heard that what was probably a sperm whale had been seen on the foreshore some 50 miles by water from Paramaribo, and we determined to attempt to secure its skeleton. We therefore hired a small open pilot launch and, leaving the town at four-thirty one afternoon, towing a tiny corialle, reached the open sea at sundown. Although it was high tide, a 5-foot pole was needed to find our way over the endless mudflats and sand-bars, which here extend for miles out into the sea. The great rivers pierce these shallows, but even the liners calling at Paramaribo must push their way up to the town with their bottoms deep in the silt. At midnight we found the whale: a heaving mass of rich, yellowish, and considerably decayed flesh, rising and falling with the swell at the foot of the mangrove trees alongside the mud-bank which there does duty as a coast-line. Before we could reach the shore to land our gear however the sea melted away, leaving our craft high and dry in the middle of an inlet leading to two small creeks. We settled down to sleep after erecting a tarpaulin on poles stuck into the mud to ward off the trade wind and the early morning rains. At about three-thirty a gentle air drift began from landward, bringing with it countless sandflies. Their bites were like fire, and we spent the next five hours in the greatest discomfort until the tide came in and we could land and establish our camp.

The launch returned to Paramaribo and we set up a rough camp with mangrove saplings, tarpaulins, and boxes upon a sand-bar about 1 mile long, 30 feet wide, parallel to and touching the high-tide mark. To one side

were the mud-flats or the lapping ocean, to the other a slimy flooded morass of black mud beneath a forest of mangroves. When the fresh trades blew from 9 a.m. till midnight, the location was delightful; but between times sand-flies and mosquitoes made life intolerable. From all accounts the whole coast of the Guianas is but a repetition of this spot.

The place had a powerful though distant beauty all its own. The air was clear, the light ultra-vivid. When the tide went out—to such a distance that the sound of the waves was inaudible—flight upon flight of shore-birds descended upon the mud-flats. Many thousand Red Ibises sprinkled about the dun-coloured mud, serried ranks of glistening white egrets, intermingled with bright-blue herons and brown bitterns, stood by the sherry-coloured streams that issued from the little creeks, and endless flights of green parrots passed along overhead. The life that issued from that desolate place with the retreat of the tide was inconceivable. During our stay we came across crab-eating raccoons, vultures, and crabs of every kind that dwelt in and upon the mud and even in the mangrove trees. There were snakes, and in every pool the remarkable four-eyed fish that have a pair of lenses for vision in the air and another for use below water at the same time. There were also immense woodlice and certain very queer insects: great earwigs and large red flies.

We penetrated the mangroves far inland. The trees were apparently endless. Every now and then long meandering low ridges of shell sand occurred parallel to the coast. These are formed by mechanical action on the part of the sea, which is constantly biting into or throwing up new sections of the coast. The specific gravity of the shells is less than that of the mud, so that when the animals within them die they are gradually brought to the surface, where the incoming tide gathers them up and deposits them at high-tide mark. If the coast-line is then added to at that point the shell-bank remains on the surface and in due course, with the continuous retreat of the sea due to general deposition, goes farther inland. This accounts for the shell-sand beds round Paramaribo, now 10 miles inland.

We managed to get about the mud-flats at low tide and to and fro between the whale and the camp by using the small canoe as a sled, wading beside it in the mud. This mud is black when wet and covered by a scum of olive-brown algae and diatoms. When dry it is almost white, and of the fineness of face powder. Sores on our legs healed much more rapidly while wading in this mud all day than at other times. The surface of the foreshore is not smooth and even, but carved into endless miniature canyons sometimes 4–6 feet deep, at right-angles to the land.

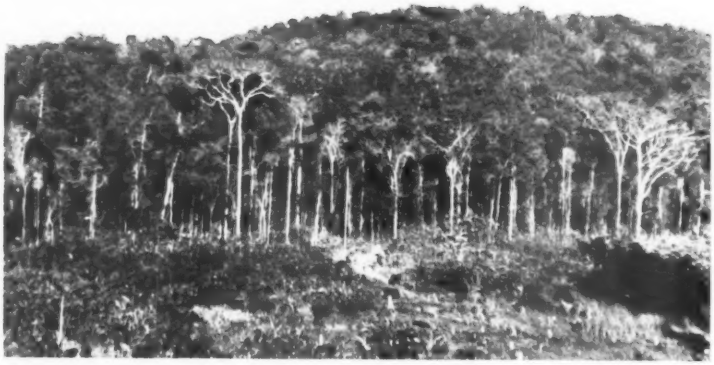
Our operations upon the whale took five days, during which time we cut up the whole carcase and extracted the skeleton, but were unable to lift the skull from the mud into which it had sunk.

The trip up the Coppename river

When our permanent equipment was sufficiently advanced for real bush work we decided to investigate the forests farther afield. Our only means of getting to such places was by river, and I had therefore purchased a sturdy little motor launch, 23 feet by $6\frac{1}{2}$ feet beam, with a complete zinc roof, copper bottom, and motive power provided by a single-cylinder Wolverine marine

Amerindian woman moulding pottery without a wheel A. V. S.

Juka canoes on the Coppename river A. V. S.



Rain forest in the foothills *A. V. S.*

A natural flying-field on the open savannah *A. V. S.*

Burnt savannah bordering the Para river *A. V. S.*

engine. This was brought up to the small creek that crossed the Groote Combeweg near our house and there refitted. We also bought a *boato*, which is a craft peculiar to Suriname, made like a canoe and pointed at either end, but constructed of long planks bent over U-shaped cross members. We then gave up our house and somehow fitted thirty-nine loads into the *boato* and launch, besides ourselves, 70 spare gallons of mixed gas-oil and kerosene, André, our skinner, and a seventeen-year-old Portuguese lad, Rici, who was to be cook and general household factotum, together with their food and belongings. The two boats were lashed side by side.

We left Paramaribo at six o'clock one evening in June and entered the canal joining the Suriname to the Saramacca river, through which we proceeded by moonlight. We tied up in the Saramacca river opposite Uitkijke at midnight. The following day we descended the Saramacca river, passing Groningen, and at seven o'clock we were well within sight of the open sea and the river had widened greatly. We hugged the southern bank, which was here lined with tall mangroves. We had heard it said that we must wait at the mouth of the Saramacca until four-thirty in the morning, when the trades drop, before attempting to round the point into the mouth of the Coppename, but in view of the facts that our engine was for the first time functioning evenly, the night was clear, there was no wind, and a bright moon, we had decided to carry on while the going was good. A mud-bank presently forced us out into the stream, and then we began poling in the hope of finding a channel through which we could keep close to the left bank, which was rapidly becoming a foreshore. These mud-flats forced us farther and farther offshore, and at nine-thirty, when the line of mangroves was but a ghost upon the horizon, an immense cloud suddenly obscured the moon, and a few minutes later we shot over a broad foam-line into inky black water where we could not find bottom with our pole. We could not find the mud-bank again and after a time a fresh breeze sprang up from an unexpected quarter. This alarmed us considerably, for the launch had but 3 inches freeboard down aft, and the *boato* was loaded to her very gunwhales with a solid mass of cases. The darkness was intense, and water began to slop into the *boato* in ever-increasing volume. We proceeded through the night with some trepidation and for a considerable period, having set a compass course due south, while all hands baled furiously in the *boato*, until the moon came out from behind the cloud and we discovered that we were out of sight of land. Several hours later the shore appeared ahead, and we eventually anchored in the lee of the point that forms the east side of the mouth of the Coppename river.

The explanation of our wandering was as follows. A very extensive mud-flat runs out from the point between the two rivers, both of which actually entered the sea in a north-westerly direction, whereas their currents were directed in a north-easterly. We approached this mud-flat on the shallow side in the Saramacca with a falling tide, and eventually shot over its extremity into the flood waters pouring out of the great Coppename river. At absolute low tide these waters were hurrying seaward at a speed with which our engine was unable to contend, and, in the total darkness occasioned by the disappearance of the moon, we had been washed out to sea backwards until we were in the trade wind blowing outside the eastern point of the mouth of the

Saramacca. The turn of the tide had overcome the flood of the river, so that we had eventually come ashore. The size of these great tropical rivers is unimaginable to those who have not seen them. The Coppename is not longer than the Thames, but its width and depth are out of all proportion.

The small group of hamlets known as Batavia which lies on the east bank a few miles up the Coppename river has a mixed population, though predominantly Amerindian. There is a small school, church, and landing-jetty. Above this point the river contracts considerably, and there are no further settlements of any kind except Kaaimanston. The banks are lined with tall mangroves, behind which palms and other growth gradually make their appearance, increasing in profusion until they reach the water's edge, which then becomes bordered by masses of pale-green bushes looking and smelling like wild roses and by tall single-stemmed plants with immense heart-shaped leaves, growing in the water. There were schools of river dolphins, but few other signs of life. After a day's pause near Batavia, we continued upstream, with many halts to repair the engine, and eventually camped a few hundred yards below the entrance of the Waijombo river or creek.

This is an astonishing river that flows both ways and connects the Coppename and Nickerie rivers. Using the Waijombo, the canal between the Saramacca and the Suriname, and the Wane creek between the Commewijne and the Marowijne, it is possible to go by inland water from the eastern to the western border of the country, with the exception of the short passage round the point between the Saramacca and the Coppename. This is the route used by all river traffic between Paramaribo and Nickerie. The whole marine plain is carved up by long winding creeks and is remarkable in other respects. The Coronie swamp, consisting of soil to a depth of several metres, is in some manner suspended upon several more metres of water. The banks of the rivers, as in many delta areas, are the highest parts of the land surface. Behind them the land is several feet below the river-level, and is usually flooded. This strange country was the object of our investigations while at this camp.

The forest is dense and unbroken over the whole area, but it is remarkably unvaried in botanical make-up. The majority of the deciduous trees are *moras*, whose great kidney-shaped nuts cover the ground or float upon the swamp waters. Beneath them grow a profusion of palms, most of which are covered with long slender black spines and lance-like thorns. The floor of the forest undulates gently, the rise and fall being but a couple of feet, so that long snake-like strips of sodden ground meander hither and thither through the otherwise totally flooded land. As one penetrates the forest away from the rivers less and less land is apparent and the swamps become deeper and deeper, until one must wade through water up to the waist.

The animal life is very peculiar. On the ground most notable are the giant anteater, the tapir, the crab-eating fox, and capybara. Almost everything else has gone up into the trees, including the frogs, snakes, lizards, snails, and most of the insects. Almost every tree is festooned with ants' nests sometimes 5 feet in diameter, and every palm tree houses one enormous hairy spider with jet-black fur and bright orange-tipped legs, resting at the base of one of the fronds, some 8 feet above the ground.

An incident that occurred at this camp illustrates a very interesting point. Anybody who has experience of the equatorial forests knows the ease with which one can get lost. Allsop went out to shoot one morning and was lost all day, as was also André, who set out to search for him. Usually it is useless to shout for help in a forest, as the tree trunks break up and obliterate sound in a remarkably short distance. Here however we discovered that the flooded forest floor had the contrary effect and produced, in fact, tremendous echoes on all sides. A very considerable number of people disappear every year through being lost in the bush, and there are stories of experienced hunters being lost for days within a few hundred yards of large clearings. The forests of Suriname moreover, without native settlement or paths, present nothing that is edible to those who get lost, the animals being extremely wary and well hidden and there being no edible fruits or nuts.

After passing the Waijombo creek there was nothing but endless miles of virgin forest. Only two small settlements were marked upon the map, the first an Amerindian village named Heidoti, the abandoned location of which we eventually stumbled across by accident, and, farther upstream, Kaaimanston, a Juka village of renegades and outcasts from the real bush-negro country, which lies to the east. We were several days reaching the latter, because of engine trouble and frequent stops for collecting.

As this was our first visit to any Juka community, and we only knew of the customs of the country by hearsay, we decided to adopt the etiquette customary in West Africa upon such occasions. This move moreover proved to be thoroughly appreciated. After commune with one of the older men who awaited us on the foreshore, we sent word to the Captain, as the chief is called, and then retired to change into our best clothes and await his coming. This, just as in West Africa, was preceded by a surfeit of lean dogs and accompanied by almost the whole community, also in its finest regalia. Presents were exchanged and we were invited into the village for palaver, which was also, we were delighted to find, conducted upon strictly traditional African lines, the Captain and I conversing only through interpreters even when we did understand each other. Having thoroughly examined each other upon our respective businesses we were invited to inspect the village, which was a complete replica of forest settlements that may be seen in West Africa.

The small rectangular houses of wattle and daub with plaited palm-thatch roofs were scattered round a garnished area of hard-beaten earth in the centre of which stood a large wall-less building with high pent roof. In this the women were pounding garrie just as they do in Africa. The lintels of the doors to all the houses were heavily carved with traditional African motifs, one of which is customarily seen in Yoruba country in Nigeria. In some cases the whole end of a house would be of crude planks entirely carved in such formalized designs.

The Jukas adopt shifting cultivation, and some of their small clearings are many miles from the villages. At Kaaimanston they extend far up and down the Coppename river and up all the side creeks. These farms are recognizable only by the fact that all the great trees are isolated, dead, barkless, and white. Beneath them the ground is covered with a dense tangled mass of vegetation like any other bit of open bush. Visit one of these with its owner and demand

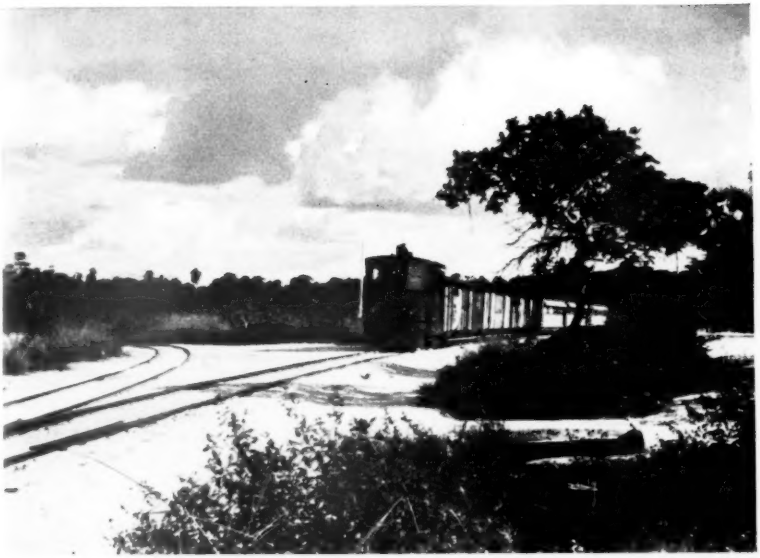
plantains, bananas, yams, cassava, tania, or other vegetables and he will dive headlong into the green mass hacking and hewing to right and left, presently to appear with great armfuls of the required products. There is no order or design in the planting. The food plants grow at random and fight with jungle growth for their existence. There were no stock animals at Kaaimanston and but few fowls. In fact, there was a great lack of all foodstuffs apart from garrie-bread, a few sweet potatoes, and bananas. The inhabitants live mostly by cutting cedar, greenheart, and other woods, which are floated down the river in large rafts and towed up the Saramacca and through the canal to Paramaribo by the launches of contractors. They also collect much balata or wild rubber.

After this call we proceeded upstream again by easy stages. We intended to camp immediately below the Raleigh falls, which are the first cataracts of the Coppename river, but after some days we discovered that we were making hardly any progress at all and burning an excessive amount of fuel. Two Jukas who had accompanied us in their corialle finally stated that it was useless to attempt any further advance upstream, pointing out that the river was "twice the height of a grown man higher than ever before" within the memory of the oldest living member of the community at Kaaimanston. We therefore decided to camp and await the fall of this unusual spate.

This we did upon the face of a steep hill that dropped directly into the left bank of the river. Here we constructed three permanent *m'jupas*, or bush houses, with tarpaulins and palm thatch, more by our own efforts than by the help of the two Jukas, who were indifferent workers and surprisingly lacking in both the essentials and the finer points of bushcraft. In fact we amazed them with many simple African tricks and devices in house construction, fire-building, bush-clearing, and thatching, while they in turn dumbfounded us by absolutely refusing to do any kind of work on the third day, which turned out to be a Sunday. They have been Christians for a generation. When we were comfortably settled in, they departed downstream, and we were left utterly isolated in the beautiful jungle, with the positive knowledge that nobody at all was within 30 miles of us; the nearest people being the inhabitants of Kaaimanston.

The forest here was entirely different from that in which we had stayed by the Waijombo creek. Here the land was beginning to rise into the first foothills, though no land was high enough yet to be seen over the trees or up the river. The banks were high, and beyond them a sort of pent-roof topography extended away indefinitely, steep ridges alternating with narrow gullies. The soil consisted of deep humus and dry leaf mould on the more level areas, but the sides of the ridges were often covered with exposed laterite, whereas most of the gullies were floored with level beds of golden sand.

The trees were higher and very varied, acacias being very numerous. There were fewer palms below and these mostly grouped in natural groves, beneath which the ground was almost entirely bare. The whole land was littered with fallen tree trunks and riddled with holes excavated by animals. About 2 miles inland from the river on the east bank the ridges became much wider and levelled off, forming miniature plateaux. Here the trees were smaller and sparser and, although we never reached them, we have good



The weekly train crossing the savannah *A. V. S.*

Mobile equipment cases at the railhead *A. V. S.*

A male saki monkey *A. V. S.*

André and a captive capybara *A. V. S.*

reason to believe the reports of the Jukas that they eventually give way to large level areas of savannah. This would be consistent with what is seen farther east between the Saramacca and Suriname rivers.

Our work here consisted of the usual collecting; in addition we were experimenting with our new equipment and methods, many of which had up till that time only been theoretical. Many attempts, like bat-traps, smoke bombs, and sirens, proved highly successful; others were very much the reverse; but on the whole our collections far surpassed anything we had ever obtained before in such country with so small a staff, and at a time when excessive rains had driven most of the fauna either far back from the rivers or into that remarkable form of temporary retreat which tropical animals, especially mammals, fall into during periods of continued heavy rainfall.

We hung on here to the end of our food and fuel, in the vain hope that the rains and the river might abate, but we had to abandon our final objective. For the first time in twenty years there was no intermediate dry season in 1938. It was, moreover, only by drifting downstream for some 80 miles to conserve our fuel, feeding almost exclusively on two Edam cheeses and smoking native tobacco in pipes, that we eventually got out without great difficulties or much undesirable labour.

The Para river

After three days in Paramaribo restocking our supplies and shipping most of our preserved specimens, we set out again. Unfortunately both André and the ever-cheerful Rici collapsed with bad fever on their return to Paramaribo, and we had to depart with two new personages strangely similar in appearance but very different in all other respects. I only mention this matter in a desire to stress the importance of the careful selection of local staff for serious travel or collecting trips in tropical countries. One of these two substitutes during the week that he was with us entirely wrecked our organization and broke up the commissariat for the following two months by his inefficiency. André and Rici fortunately rejoined us a few days after we reached Zanderij.

We intended to travel up the Para river, and this we certainly accomplished in the end, though the doing of it was at times rather wearying. Our troubles began with a complete failure even to find the mouth of the river where it enters the Suriname, and culminated when the boy mentioned above dropped a most important case and his only pair of trousers into the swift-flowing river at the one time when the engine was functioning properly.

This river, though 50 miles long, had an S-shaped mouth flanked by tall mangroves just wide enough to allow the entrance of our craft, and in its lower reaches was often no more than 15 feet wide. Its water was the colour of port but very clear. The colour is due to plant juices and mineral content, and all the Guiana rivers are similar. The Para flowed between an endless phalanx of tall, luscious plants that grew in the water. Little side creeks and bays were filled with yellow, white, pink, and red water-lilies. The jungle to either side was a tangle of every kind of tree with palms and feathery acacias predominating, but one and all clothed in a patchwork of flowering creepers and festooned with natural baskets of orchids. In the higher reaches the whole river simply plunged into a low forest where great trees stood in the water.

The sunlight, in which immense iridescent blue butterflies and flame-red dragonflies danced, filtered greenly through the foliage and bespattered the absolutely smooth, mirror-like water. A low bridge combined with high water necessitated our abandoning the launch and *boato* at Republiek, whence we continued by canoe up the Coropine creek for a further 4 miles to Zanderij. This tiny creek dwindles away to a width of 3 feet, beyond which even tiny corialles cannot go, but may be followed farther to its source, a small marsh out upon the savannahs beneath a group of palms.

At Zanderij we lived in a house, lent by the Agricultural Department, which was connected with an experimental farm nearby. Here we not only carried on our collecting activities and experiments upon procedure, but also completed the remaining half of the equipment cases, as well as the alteration, redesigning, and repair of several of those made in Paramaribo. This made our schedule very full, and we were kept in a perpetual rush by a quite unexpected but very welcome influx of specimens from our traps, from the inhabitants of a nearby Amerindian village, and from the sturdy negro people of the Para river. Our purely biological researches proved of great interest at this place, because we were upon the edge of the savannahs, in which lay remarkable swamps supporting a fauna new to us and with very singular habits. Ordinary toads scaled tall trees, typical ground-living frogs climbed bushes, snakes were found in holes full of water, and certain rats built open nests like birds, while another rat was only represented by a strange mutation, all its members being utterly tail-less. In addition this was the home country of the bush-dog (*Speothus venaticus*), a little carnivore not unlike a sturdy dachshund with a perpetual leer.

The forests that bordered this savannah to the north-east, north, and north-west were totally destroyed fourteen years ago by a fire which swept across a very wide tract following the course of the Para river and Coropine creek, both of which were that year bone dry. The new growth on this land also supported an unusual fauna, not seen elsewhere, which was probably temporary. The forests to the east were some of the tallest and finest that we saw in the country, and from them we obtained the rather startling saki monkeys, the male and female which differ widely both in colour and pattern. The behaviour of a species of bat of the genus *Molossus* at this place was also very unusual. A great colony of them shared our house and mingled with ourselves and our possessions at will and without fear. At times they would alight on the dinner-table and allow themselves to be stroked or even handled before running off like mice and taking to the air. We eventually noticed that this behaviour on the part of the bats coincided with the use of a certain perfume by my wife, and we conducted some simple experiments which tended to show that this was in fact the cause.

The savannahs consist of enormous dead-level areas covered with very short grass and sand, with great islands of dry, xerophytic bushes and small trees with sparse leaves. They are ringed with natural hedges of dense tangled vegetation upon which crawls a network of an immensely tall, branching grass whose slender leaves bear cutting edges finer than those of a razor. Here and there shallow marshes occur, choked with stout tufted grass, tall flags, reeds, and isolated tall palms. Farther south there is less

open short grass and the islands of tangled vegetation coalesce hither and thither, making an impenetrable welter of dry greenery.

This is the country preferred by the Amerindians, who have several villages scattered about this belt. That nearest to us consisted of two score houses and was presided over by a cheery, bright-eyed little Captain, with a love of guns and vermouth. The village was neatly kept, and in it one could watch every stage in the many beautiful handicrafts, such as the making of pottery without a wheel, hammocks that take a year to complete, mats, fans, immense drums, and all the other artefacts necessary for the livelihood of the community. In fact these people seemed to buy little but vermouth and occasionally a gun from the outside world. Everything else they gathered or made for themselves from their own raw materials, though a little railway passed nearby and a train, in which most of them had at one time or another been down to the coast, stopped every week. They must have been a wonderful people in bygone days, and they are still magnificent hunters with an indigenous knowledge of the country and its products and possibilities. This is just what the bush negroes lack, as is very apparent from their mode of living.

Zanderij during the hot season, with its bare ground covered with sand as white as snow, was not a comfortable spot. The absence of good water once the only rain-butt was exhausted also contributed to our discomfort, so that when the equipment was finally completed and all our collections packed we were ready to make a move. Just then Allsop met with a most unpleasant accident. He received a jet of formalin solution in both eyes, and had to return to Paramaribo for treatment. As soon as he was fit again we boarded the weekly train and travelled up the line to Halt 91½, which is that distance from the terminus in Paramaribo reckoned in kilometres.

The first foothills

Six miles into the virgin bush from Halt 91½ there was a clearing made two years previously by a British gold-mining concern. All that remained now was the assay office, in charge of a good friend and compatriot of ours. The other activities of the company had moved farther up the line. Here we were installed through the courtesy of the Van Emden Goldfields, Ltd., in the abandoned hospital premises, which were in the finest order.

It was here that we put our new methods through a gruelling set of tests extending over a period of two months. The surrounding country was perfect for our work, being totally uninhabited and clothed in unbroken tall rain forest upon a pent-roof topography of sharp ridges and narrow intervening gullies, like a giant ploughed field. The collections were of special value because the fauna altered considerably here, due to the absence of flooding, the greater proximity to the highlands, a slight change in flora, and a greater difference between wet and dry seasons in that important environmental belt immediately above the ground surface.

There was a nearby hill known as the Donderberg, about 800 feet high, but otherwise the country was remarkably similar to that encountered elsewhere in Suriname. Though there were large areas covered with deep humus, a far greater proportion of the land surface was covered with a thin layer of

small ironstone pebbles or gravel. These little nodules are said to form *in situ* as a result of chemical action set up when the banded shales are exposed. There are also many small lenticular reefs of quartz (containing gold in some areas), which form small ridge-like outcrops. In some places the whole ground is strewn with remarkable cubic crystals of decomposed pyrites or limonite which may be as much as 2 inches in diameter. Many of the gullies are partially filled in and levelled with alluvium in which most of the gold has been found in this country. It was about 3 miles to the east of the Donderberg that we came across the largest trees that we saw in the country. The forests are very rich in precious woods, greenheart, purpleheart, etc.

Our work at this place was concluded at the end of November, and it became obvious to us that any extension of it upon the basis then laid down would not warrant further expenditure. Great pressure of other work however, which had to be carried on through the medium of the very sparse and laborious postal arrangements, made it equally clear that we would be unable to carry out the Courantyne river expedition. At two days' notice we returned to Paramaribo, and within ten days we sailed for home.

Note on the scientific results

The permanent equipment planned was completed, with the exception of certain cases that could only be constructed in England. Of a total of 74 planned and designed, 61 were made. Of these, 39 were used for mobile work on trips into the interior, the remainder being left at the base filled with supplies, as duplicates, or empty for the reception of specimens. All cases were constructed of seasoned local cedar wood and lined with thin zinc sheeting. None weighs over 60 lb. when fully loaded and all are fitted with trays and partitions so that there is no packing or unpacking at any time, apart from tents and bedding. Their contents are classified and packed accordingly.

Improved methods of collecting, preserving, and packing the animals were tested. These included a great number of separate experiments with traps of new design, sirens to drive animals out of holes, blow-torches to ignite chemicals and cause smoke in hollow trees, and other such devices.

We were more especially concerned with a careful rationalization of our total time, money, and activities. We established an experimental collecting centre (at a camp), set out traps, caught and prepared animals, catalogued and artificially dried them, and packed them ready for shipment in one experimental period of a week. In this time, with only one native skinner, we obtained as many animals as we had previously had in one month in the same type of country with twelve native staff and a dozen extra untrained native collectors. In addition the total average cost of a given six months in the field was £350 compared with £600 for a previous expedition run upon the old lines (the cost of travel was, moreover, 32 per cent. higher per 100 miles in Suriname); and the animals collected in the two cases were of the proportion 6000 in the former to 4200 in the latter.

It is hoped that detailed reports upon those specimens which prove to be new to science, concerning which new data were accumulated or which require systematic readjustments, will in due course be published in the appropriate journals. The bulk of specimens collected is large, and the final

shipment only returned with us at the beginning of this year, so that there is a considerable amount of data accumulated in the field to be correlated with the findings of specialists working upon the preserved material.

The groups collected were mammals, including uteri and an unusually large number preserved whole in spirit; reptiles and amphibians; parasitic Arachnida; parasitic insects from the vertebrates collected only; parasitic worms from the vertebrates collected and from birds obtained for this purpose only; Arachnida other than spiders; freshwater and terrestrial Mollusca and Crustacea; and extraneous groups comprising odd specimens of other groups that were of particular interest or value, such as *Peripatus*.

APPENDIX: PLACE-NAMES IN SURINAME

The following list of native place-names is given in the official Dutch spelling as appearing in the 'Atlas van Tropisch Nederland' (1938) and the 'Overzichtkaart van Suriname' (1927); in case of doubt the former may be regarded as the more authoritative. The names have been transliterated by the R.G.S.II. system, and in addition dots have been placed before the stressed syllables (cp. *Geogr. J.* 92 (1938) 540).

	R.G.S.II
Avanavero (Dalbana)	·Avana·vāro
Coesewijne	·Kŏse·waine
Commewijne	·Kŏme·waine
Coppename	Kŏpe·nāme
Corantijn (English: Courantyne)	·Korantain
Coronie	Ko·rōni
Coropine	·Kŏra·pine
Cottica	·Kŏtika
Heidoti (extinct village)	Hai·dŏti
Kaaimanston	·Kaimanston
Kabalebo	Kāba·lēbo
Kwakoegron	·Kwākegrŏn
Kwatta	·Kwătă
Lawa (Lama) (French: Aoua)	·Lāwa
Marowijne	·Mărŏ·waine
Miendrinetti	Minyon·eti
Moengo	·Mungo
Nickerie	·Nai·kīri
Para	·Părā
Paramaribo	·Părā·mărī·bo
Santigron	·Săntigrŏn
Sara	·Sărā
Saramacca	·Sărā·măkă
Suriname	·Surinēm
Tapanahoni	·Tăpănăhōni
Tibiti	Tībitĭ
Uitkijk	·Ötkēk
Waijombo	Wai·ŭmbo
Wane	·Hwāna (meaning "water" in Carib)

DISCUSSION

Before the paper the PRESIDENT (Field-Marshal Sir PHILIP CHETWODE) said: In introducing the reader of the paper, Mr. Ivan Sanderson, I would remind many present to-night that he read an interesting paper to the Society some time ago on an expedition to the British Cameroons. Since then he has been at his work as explorer and naturalist in Haiti. To-night Mr. Sanderson is going to talk on an interesting expedition to Dutch Guiana, which is a delightful part of the world.

Mr. Sanderson then read the paper printed above, and a discussion followed.

H.E. The DUTCH MINISTER: It is really rather embarrassing to be asked to take part in a discussion on territory of ours about which I know very little and the lecturer seems to know everything. But I am sure I can say that every one has been as interested as I have been in seeing his most excellent series of slides and listening to his rapid survey of the experiences of the expedition in Dutch Guiana. I can only add that I am grateful to the Royal Geographical Society for the invitation which enabled me to hear the lecture.

The PRESIDENT: It only remains for me, if nobody else wishes to speak, to voice what I am sure is the opinion of this audience, namely that what appeared, perhaps, at first as rather a dull subject dealing with a far-away country which none of us knows much about has been made into one of the most interesting lectures we have had here.

May I ask one question? Mr. Sanderson has said that the soil of Suriname is very rich. Is it possible, without immense expenditure of capital, to introduce Europeans into the country? Would they have any chance of making a living at farming or anything else?

Mr. SANDERSON: You ask a question which has been in the forefront in view of the refugee problem. White people going out to Dutch Guiana without any experience of the jungle would find life extremely difficult. The soil is very rich, especially on the coast, but it is a question of clearing land. To do that people must cooperate in large bodies; it is not only a matter of cutting down the trees, for when cut they have to be removed. If that is not all done quickly and the land planted, the soil deteriorates. Having cleared the land those concerned would have to be pretty experienced tropical agriculturists, because if they were far up above the flood forest, up in the real rain forest, as soon as they took away the covering of trees the soil would disappear. I know places where the tops of the ridges are absolutely sterile, the soil having been washed away by rain; what is more, small nodules of laterite are washed out and the soil becomes quite unfertile. The country is, of course, very rich down by the coast, where there is soil.

The PRESIDENT: I asked that question because I feel sure you will all agree with me that one of the most distressing problems at the moment is how to dispose of the many thousands of refugees. I think every Government in the world is trying to find somewhere to put a few. But the lecturer has told us, and I am sure His Excellency knew before I asked the question, that this is not a country into which one could possibly put any quantity of refugees even if the Government were ready to take them, because it would cost far more in capital expenditure than would be justified.

I have no more to do than to ask you to accord in the usual manner a unanimous vote of thanks for a most interesting evening.

RECENT COASTAL CHANGES IN SOUTH-EASTERN ENGLAND: A DISCUSSION

Continued from the May Journal: Afternoon Meeting of the Society, 13 February 1939

IV. CHANGES IN THE WASH

O. Borer

As far as the Wash is concerned the only erosion of which I know is that taking place on the Hunstanton cliffs, although the coast running in as far as Snettisham would probably be eroded in places were it not for the construction of groynes. The foreshore here consists of shingle and sand, but it is always held that the shingle does not pass beyond the river Ingol, which enters the sea at this point. On the other hand, much work has been done by the North Norfolk Catchment Board along this stretch to prevent the inundation of the land in the neighbourhood of Dersingham and Wolferton. This attack of the sea is probably due to the weakness of the foreshore in withstanding storm conditions.

As far as the rest of the Wash is concerned accretion, and in certain places reclamation, is generally found; nor is this reclamation of recent origin, for in pre-Roman times this portion of the east coast of England, as far north as the Trent and as far inland as Huntingdon, was a vast marsh, through which the rivers Trent, Witham, Welland, Nene, and Ouse wound their way. In the course of time this land rose through the deposition of alluvial matter aided by the constant growth of vegetation.[1]

On the map we see to-day the remains of an old bank, termed the Raven Bank, running from Cowbit roughly parallel to the coast, and farther out, but still 5 miles inland, a bank which is known as the "Roman Bank."[2] The Romans are known to have farmed this area until they left in A.D. 359.

From that time until the seventeenth century there is no record of anything being done to help the natural process of accretion. Disastrous floods occurred during the early part of the reign of James I and probably called attention once more to the fen areas; during his reign a large tract of land in south Holland was enclosed by a bank, and further banks were built from time to time and more land enclosed.

During the seventeenth century no less than 35,000 acres were enclosed, while in the next century a further 196 acres were enclosed, followed by 9000 acres in the nineteenth century. The relatively great amount of enclosure in the seventeenth century arose simply from taking advantage of the accretion which had been going on steadily since Roman times. In the same way the 9000 acres enclosed during the nineteenth century were partly the result of alterations in the outfalls of the various rivers. Another noteworthy

[1] For Fenland details, see H. Godwin and M. H. Clifford, *loc. cit.*, and for historical data see H. C. Darby, Victoria County Histories, Huntingdonshire, vol. 3, 1936.

[2] The "Roman" bank is probably not Roman in age: it was Dugdale who suggested it might be. As the name is current it is used in this article.

feature is that the land that was enclosed between the south Holland embankment and the Roman bank was at a level of 13–14 feet above mean sea-level, whereas that between the Roman bank and the Raven bank lay between 9 and 11 feet. On silt lands there is relatively little settlement, so that the additional 3 feet in height is in consequence of allowing nature a longer time to build up the land levels and incidentally to increase the agricultural value. This is a point that must be carefully borne in mind: the longer accretion is allowed to proceed the better will be the land, a factor that was forgotten when areas were enclosed in the nineteenth century at too early a stage in their development.

Of the land that has been enclosed since the Roman occupation, some 8000 acres were from the marsh along the Norfolk coast, with a frontage of 10 miles, while 37,000 acres were in the south Holland area of Lincolnshire, near the parishes of Sutton and Holbeach, with a frontage of 19 miles; the remainder is along the coast of north Holland. Accretion as a natural process is a very slow matter, and must be assisted by some artificial means. In fact Mr. Wheeler recorded the process as practically stationary unless artificial means were used to hasten the deposition.[1] As a general rule in the Wash warping, that is, the deposition of loamy particles, begins to take place at a level of +5 feet above Ordnance Datum, which is about 13½ feet above the mean low water in the estuary, which has been determined by the Admiralty as −8·7 feet Ordnance Datum. Neap tide rises to a level of about +8 feet, and it is at this level that the samphire (*Salicornia*) commences to grow, and when the soil has risen by about 2 feet above the ordinary neap tide level it is gradually replaced by grasses. The new salt marshes have a general level of about +11 feet, and some of the later marshes reach +13 feet. Considering that the high spring tides attain a level of 12½ feet the marshes can only be built up to a level of 13 feet after they have stood for a considerable time, so that it would appear that the land between the Roman bank and the Raven bank was enclosed shortly after it had risen above the level of the neap tides, while the land enclosed in the seventeenth century had been allowed to rise even above the normal spring tides, which means that the top of the soil consists very largely of warp or loamy particles and that the siliceous particles of silt and sand which could no longer be in suspension at this high level are excluded.

In the same way the period of time required for the necessary accretion will vary with the situation of the marsh and the artificial assistance that is given. As a general rule after an enclosure bank has been built, the land on the foreshore outside will become grass marsh in about ten years, but a further twenty to twenty-five years must be allowed to elapse before enclosure takes place to secure the maximum value. During this period marine growths and grass will filter the finer particles of warp, and roots and decaying vegetable matter will fill the soil with organic matter. It is along these lines, as well as by the construction of large dams, that the German Government are applying artificial means to cause the more rapid reclamation of land along their north coast and also along the west coast of Schleswig-Holstein.

As I have mentioned, the rapid reclamation during the nineteenth century

[1] See figures given in part I above.

was in part due to artificial aids arising from the construction of river works; thus in 1837 following the construction of training works on the Welland estuary a large area of the foreshore on the Moulton and Frampton shores began to accrete; by 1851 it had all been grassed over. The area at Frampton, some 300 acres, was enclosed in 1864, and a further 800 acres were enclosed in 1875 at Moulton. In the same way land accreted in the bed of the old river Ouse after the Eau Brink cut had been made; most of this has formed some of the best pasture and arable land in the district, but some portions were enclosed too soon and would have been better land if left for a further ten years.

Consequent also upon the work of improvement on the river Nene accretion was extremely rapid. In 1832 it was decided to cut a new channel for the Nene by a gap through the Cross Keys Wash to Crabb's Hole, a distance of 5 miles, and training walls were constructed through the sand for a further $1\frac{1}{4}$ miles. This caused rapid formation of the land, and indeed it warped up about 7 feet and became good grass marsh in twelve years.

It was in consequence of this rapid enclosure that Sir John Rennie in 1839 put forward a gigantic scheme for enclosing all the foreshores. As a result of this the Norfolk Estuary Company came into being. Unfortunately for them they had to promote a Private Act, and in order to obtain the consent of the various authorities they were compelled to undertake certain drainage works, so that by 1857 they had spent no less than £250,000 on work for the improvement of drainage and navigation without being able to do any of the work for which they obtained powers under their Act. In fact by 1876, by which time they had spent £400,000, they had only been able to enclose about 1500 acres, and of this amount some 876 acres had to be given to the frontagers in consequence of the conditions which were laid down in the Act. The remainder of the 30,000 acres which they had power to enclose were still only bare sand. Accretion was going on slowly between the new channel which the Company had had to construct and the bed of the old river, but even to-day the old river still partly exists. By 1914 the Company had enclosed a total area of 2381 acres, but half of this had to be handed over to the frontagers for compensation. Since that date they have enclosed a further 800 acres.

Experience shows that the accretion of land in the Wash must be slow, and if the land is to have any agricultural value it is no use embanking it until it has risen to a certain height. In consequence each embanked area must be comparatively small, and this adds considerably to the cost. On both sides of the North Sea the process of accretion is assisted by the cutting of a series of ditches up and down the sea marsh. These ditches generally have a fall of about 2 feet to the mile from the edge of the last main embankment down to the edge of the sea grasses. The excavated material from these ditches is generally placed on the side of the incoming flood tide, thus causing still water and so enabling the flood tide to deposit, and any erosion from the newly placed earth is carried on to the grassland. These grips also enable the tidal waters to get away, and thus allow the layer of deposited silt to consolidate before the coming of the next tide. As a general rule the grips are cut about 2 chains apart, and are first constructed after the marshes reach a height of 10 feet above Ordnance Datum; with the rising height the tidal inundation

becomes less frequent, and finally only the alluvial warp is deposited, so that the higher the level of the marsh the better the quality of the land when reclaimed.

Apart from the work of the Norfolk Estuary Company the Crown Commissioners have also reclaimed land on the east side of the outfall of the river Nene. Banks were constructed here between 1867 and 1871; a further extension was made in 1917 amounting to 844 acres. This enclosure was really in the old estuary of the river Nene. The following table shows the amount of accretion that has taken place outside the Roman bank, so that up to the year 1876 the average rate was 67 acres per annum (see Table I).

TABLE I

	Before 1869 *acres*	*Since* 1869 *acres*
West side or east Holland	6,336	—
Head of the Wash including south Holland, outside the Roman bank	35,163	985
Bicker Haven and the Welland marshes ..	10,464	—
Nene marshes	9,536	1,177·6
Norfolk coast, by Estuary Company ..	1,800	1,383
Total=66,844·6 ..	63,299	3,545·6

An examination of the various maps (see Table II) suggested that there might have been some accretion and general advance of the foreshore along the stretch of coast from Wolferton to Hunstanton, where it will be noted that there is a second sea-bank, some little distance inland. The information available from the maps of about 1829 is hardly sufficient to give a reliable indication, and a comparison was therefore made with the plan of 1852 which accompanied the application for the Norfolk Estuary Company's Bill. This does not clearly indicate that there has been any advance of the shore-line.

TABLE II

	Before 1869		*Since* 1869	
	Advance feet	*Frontage miles*	*Advance feet*	*Frontage miles*
On the east Holland coast ..	1·12	16		
Along the Welland	2·00	4		
In south Holland	13·00	11	10·4 feet on 11·0 miles	
The Nene reclamation ..	5·50	7	17 feet on 8·5 miles	
On the Norfolk coast	1·55	4	29 feet on 5·5 miles	

An examination of the shoals in the Wash seems to show a totally different state of affairs. The best comparison that one can make is between the Admiralty chart of 1871 and the latest information we have from the surveys of the Catchment Board up to 1938. These were confined to an area between the Norfolk coast and the line of longitude passing along the side of the estuary of the Nene through the Knot Beacon. A datum line of latitude was assumed clear of all accretion along the foreshore, and the total area of

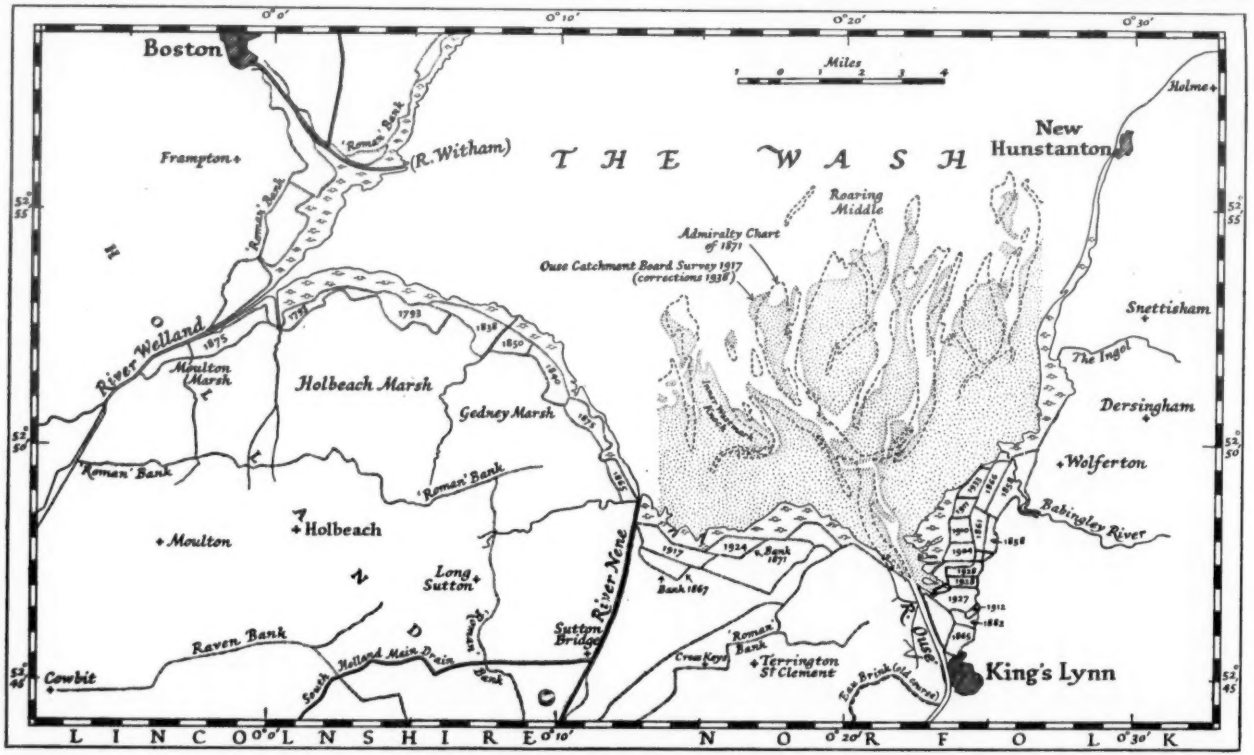


Fig. 7. The Wash: comparison between the 1871 and 1917 Surveys

sea enclosed was 5900 acres. In 1871 the amount of shoal which was visible above the Admiralty datum (−8·7 O.D.) was 30,836 acres, whereas in 1938 this had been reduced to 29,815 acres, a reduction in area of the shoals of just over 1000 acres.

An examination of Fig. 7, showing the comparison between the low-water line at these two dates, shows that generally the ends of the shoals have withdrawn towards the shore. A shoal like the Roaring Middle, which had an area of 140 acres, has now been reduced to zero, though the Inner West Mark Knock has increased in area from 3400 to 6000 acres. An attempt was made to determine how far the shoals have risen to see if this affords an explanation of where the material has gone; unfortunately the published charts are intended for navigation and show only the high spots, and as the original full survey is no longer available, no reliable comparison can be made. The Catchment Board surveys to date are not taken sufficiently close to afford any comparison between the 1917 and 1924 Admiralty charts and the present day. There appears to be no evidence that these shoals have been completed up to any height or that the material has been carried in-shore to become part of the reclaimed land. It seems clear that the drift of material into the Wash has considerably slowed down since the days between Roman times and the seventeenth century, and information on this point would be extremely valuable when dealing with the fixing of the future channels in this section of the Wash.

V. SOME ECONOMIC ASPECTS OF COASTAL LOSS AND GAIN

L. Dudley Stamp

In the constant struggle between sea and land it is the land, with the help of man, which is the gainer in the aggregate. It is natural that man should protect that which he already holds—hence the erection of sea defences of many and varied types, all designed to protect the coastlands from erosion. On the other hand civilized man has long sought to wrest from the sea extensions to the land which he owns. Sometimes his work is simply to aid or hasten the natural processes of accretion; at other times by bold engineering works results are sought which would probably never take place in nature. It is the purpose of this note to examine briefly the character and value of the land which is thus gained from the sea—special reference being made to the coastlands of south-eastern England between the Wash and Poole Harbour—and to indicate the character and importance of land which has been lost.

Let us take first the losses of the land. The preceding contributions have given examples of two main types of coastal losses. The normal steady course of erosion along many parts of our coast results in a gradual loss averaging a few inches or it may even be 2 or 3 feet a year. Such loss usually takes place where the value or utilization of the coastal lands has not warranted extensive expenditure of money on coastal defences. Hence the land lost is usually agricultural land—a strip of ploughland or permanent grass. Not infrequently the loss is anticipated, and field boundaries are set back from cliff edges, leaving a strip of rough land between the margin of the cultivated fields

and the cliff. This practice is to be commended, since the growth of vegetation on the rough strip prevents soil erosion and in general retards erosion in so far as it is due to sub-aerial agents rather than to undercutting by the sea. The loss of agricultural land between the date of the survey for the current 1-inch Ordnance Survey (Popular Edition) maps and the date of the field survey for the Land Utilisation Survey (1932–37) has often been sufficient to be shown even on the 1-inch scale. There is thus an uncoloured strip between the edge of the colour (indicating present utilization) and the old coast-line to be seen on the maps of Norfolk (Sheet 58), along the coast of Sheppey (Sheet 116), near Herne Bay (Sheet 117), round Selsey Bill (Sheet 133), and in the estuary of the Severn (Sheet 103).

Liability to continued coastal erosion is, as Mr. Steers has pointed out, a function of many variables. Not least among these is the disposition of the strata forming the cliffs or sea margin. In some cases continued erosion seems inevitable, as in those well-known cases where there is a seaward dip of the strata and the underlying rocks are clays whose surface is kept lubricated and slippery by springs. This is the position in the "Warren" between Folkestone and Dover through which runs the main line of the Southern Railway. The inevitability of further movement has been realized by the railway company, who have placed certain restrictions on the night running of passenger services. A similar set of conditions prevails in the equally well-known Undercliff west of Ventnor along the south coast of the Isle of Wight. Here the main coastal road was completely carried away by a landslip less than ten years ago. Scarcely less serious is the position in many areas where there are clay cliffs, since the angle of rest of a clay slope is very low, and even if attained along a coast is liable to be upset by wave action at the foot. Thus the attractive clay slopes (of London clay) at Tankerton (Kent) are protected by a sea-wall, yet inevitably undergo some slipping every winter. All that the local authorities can do is to keep the sea-wall, and also a promenade, in repair and to renew or realign cliff paths and steps each spring.

The incidence of coastal erosion is often particularly heavy at or near the termination of important sea defence works; for example, at the ends of sea-walls or promenades. A good example of this is to be seen at the erstwhile hamlet and haven of Hampton. At the western end of the sea-wall and promenade of Herne Bay a small stream reaches the coast near which a wharf had been built. The hamlet consisted mainly of a row of brick-built cottages along a road at right-angles to the sea. In 1906 certain of the cottages were being offered for sale at the normal prices ruling in the neighbourhood; in 1914 the imminence of erosion danger had become apparent. By the spring of 1921 the end cottage had collapsed partly into the sea. Shortly after, the whole row was pulled down for the sake of the bricks, and now the site is below high-water mark. The loss in this case is an aesthetic gain to the district.

Thus the first main type of coastal loss is a steady eating away of the land by a combination of sub-aerial and marine erosion, accentuated by the geological structure of the coast-line. In many cases it is, for all practical purposes, unpreventable. Though the loss is steadily progressive, the actual cliff falls and slips tend to occur during storms or when the combination of climatic

conditions is abnormal. There is thus no real distinction from the second main type of coastal loss—sudden and catastrophic losses. These are spectacular; they attract the attention of the Press more especially as they usually occur when the forces of nature overcome the defences erected by man. Actual loss of land is less important than damage. This is well shown by the case described by Dr. Mosby. As a result of the Horsey floods of 1938 no land has been lost, but the damage in the area is by no means confined to buildings. Such a flooding by sea water actually changes the character of the soil. After the Horsey floods a party of local landowners visited Holland to obtain information on restoring land flooded by the sea. Their report [1] emphasizes the following points:

(1) Quick, easy, cheap recovery is a myth.

(2) Recovery can only be effected by good deep drainage to assist in washing out the salt and in restoring soil texture. This is an essential prelude to restoring; money spent on cultivation or manure is otherwise thrown away.

(3) Only superficial cultivation down to 2 or 3 inches must be attempted at first, and there must be no ploughing.

(4) No cropping should be attempted until salt concentration is down to 0·3 per cent. in the soil water.

(5) Dutch experience shows that if premature ploughing is attempted recovery is retarded, and in cases studied was definitely not complete twenty-two years after flooding. This was the case with the Anna Paulowna polder, flooded with sea-water for one hundred days in 1916; where ploughing was attempted in 1917 and 1918 crops were poor and recovery did not begin for five years; where drainage was first assured progress was rapid after 1918.

Another type of land spoliation or actual loss has not yet received the attention it deserves. Extensive dredging of channels for navigation in tidal estuaries appears to result, not unnaturally, in the slight foundering of alluvial flats on the margin. The consequent rise in the permanent water-table and the impeding of drainage results in a steady depreciation of land quality and value, in exactly the reverse order to that described below in connection with reclamation round the Wash. Ploughland becomes only suitable for marsh pasture; in this reeds and rushes appear; it passes to rough pasture flooded at exceptional tides, and may be abandoned. Cases may be observed along the western margins of Southampton Water. Fortunately by its very proximity to navigable tide water such land takes on a new value and potential use for the establishment of heavy industry.

Turning now to land gained we may distinguish three main types: shingle banks; sand-hills and dunes; and alluvial flats.

Shingle banks sometimes form narrow spits, as in the case of the Hurst Castle Spit, Hampshire, of which the main function from the present point of view is to protect the marshy or alluvial flats behind. Very frequently however individual spits or banks are added to by successive banks so that a considerable expanse of shingle is built up consisting of parallel, curvilinear,

[1] Published in the local Press, summarized by Anthony Buxton in *The Times*, 13 January 1939. For an interesting account of the Dutch polders, see 'La Néerlande,' a special publication of the International Geographical Congress, Amsterdam, 1938, particularly chapter 6.

wave-like ridges. This is well seen at Dungeness. In other cases the drift of shingle is arrested by a river mouth, and a broad composite spit results, as at New Shoreham. Areas of shingle are colonized with the greatest difficulty by vegetation. At Dungeness the crests of the shingle ridges remain uncovered; a few deep-rooted halophytes colonize the troughs. In any case these shingle areas are almost valueless agriculturally; here and there a few goats may find something to eat, but otherwise they are useless to both agricultural and pastoral farmers. In the past shingle areas have been left untenanted by man except for defence purposes (Martello towers of Dungeness coast; Hurst Castle, etc.), or in certain cases for the location of ammunition works or storage. As sites for industry, shingle tracts are usually unsuited. Though the banks shelve so steeply that deep water is close in to shore,[1] the shifting nature of the banks renders difficult the construction of piers or wharves, and they often remain relatively inaccessible. Of recent years they have found a new use in the location of seaside bungalow towns and summer holiday camps. A few old-established villages have also used shingle tracts, as for example the former fishermen's section of the village of Kingsdown, south of Walmer, which lies on the shingle between the cliffs and the sea, but the development is largely within the last two decades. New Shoreham-by-Sea is now a well-established town; the spread of bungalows and holiday camps on the shingle between Littlestone and Dungeness lighthouse has taken place mainly since 1934, and has been made possible by the Romney, Hythe, and Dymchurch Light Railway (a narrow-gauge "toy" railway), and still more by the concrete motor road over the shingle and parallel to the shore. Unsightly as some of the wooden bungalows may be, this use of shingle areas may be commended: the areas are healthily open and breezy, clean shingle shelving steeply to deep water affords good bathing, and there is no risk of damage by holiday makers to crops or animals. Further, the preservation of more scenically attractive stretches of coastland becomes reasonable if such shingle areas are definitely made available as recreational tracts.

Coastal sand-hills and dunes repeat in some respects the flatness of shingle banks, with two important differences. In the first place the sand can be moved by wind and, unless fixed by vegetation, is an actual or potential source of danger. In the second place the sandy areas are more readily colonized by vegetation, and thus afford rough grazing of some, if very limited, value to the farmer. It is interesting to recall that hollows amongst sand-dunes, where the water-table is not far from the surface, where the natural accumulation of humus becomes possible, and where added manures are not readily lost, may afford extremely fertile soil. It is very light, very easily worked, warm and early, and the sand affords a medium in which the plant may grow fed by any desired combination of artificial or natural manures. Thus the famous flower farms and bulb farms of Holland are mainly located in the hollows between the old and new dunes. Such a use has yet scarcely been made of the extensive areas available in Britain, and could only apply to certain restricted tracts. Of the remainder the agricultural value is low, and some forms of existing utilization are to be commended. Of seaside towns located on sandy tracts,

[1] Hall and Russell, 'Agriculture and soils of Kent, Surrey, and Sussex,' H.M.S.O., 1912. The 5-fathom line is reached within 100 yards of the shore at Dungeness.

the Sandbanks, Poole, Dorset, is an excellent example of modern development of a substantial character. The location of golf links on sand-dune areas is a good one; the links themselves are attractive (*e.g.* the famous Sandwich course) and there is assurance that adequate attention will be given to preservation of the vegetation cover and the prevention of wind erosion.

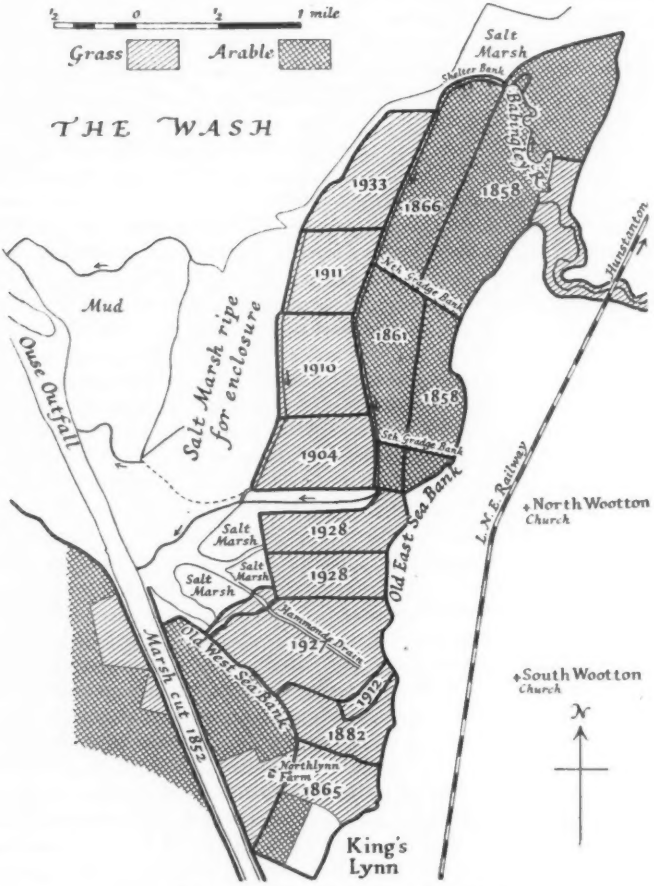


Fig. 8. Reclamation along the Wash

Dr. Mosby's account of the Horsey floods well illustrates the importance of sand-dunes in guarding their hinterland, and points to the need for control of any building development (to prevent erosion) and for constructive measures designed to assist the vegetation cover. Afforestation is a wise measure to which attention has been given recently (notably in south Wales); on the other hand erosion by rabbits has not yet received the attention it needs.

By far the most important additions to the land area are those alluvial flats found especially round the estuaries of our rivers such as the Thames and Medway, or in bays and gulfs—notably the Wash. The land is obtained as a result of natural accretion, or the processes of natural accretion aided and hastened by the construction of retaining walls and banks. Britain has not yet attempted reclamation of land by a major engineering work comparable to the reclamation of the Zuyder Zee or even of the major sub-sea-level polders of Holland, which depend entirely on artificial drainage.

First-class agricultural land occupies but a very limited proportion of the surface of Britain—probably not more than 5 per cent.—and one-third of that which may safely be scheduled as first class lies in Fenland, in the counties of Norfolk, Isle of Ely, and Holland, round the Wash. The landward portions are drained freshwater marsh, but the extensive areas of light silts between the Roman [1] bank and the sea represent reclamations since Roman times.[2] By whatever standard it is measured, this land is to be ranked amongst the most fertile in Britain.[3] During the years of agricultural depression 1931–36 the Holland division of Lincolnshire was unique amongst the counties of Britain in showing a steady increase in arable acreage. Dr. Mosby has prepared a map (Fig. 8) showing the recently reclaimed areas on the eastern side of the outfall of the river Ouse, and has briefly summarized the stages in land accretion and utilization as follows:

Elevation	*Character*	*Utilization*
5½ feet above O.D.	Wash warp begins to be deposited.	
7 ,, ,, ,,	Samphire appears.	
9 ,, ,, ,,	Halophytic grasses appear.	
11 ,, ,, ,,	New salt marsh, ready for reclamation.	Day-time summer grazing (sheep and bullocks).
	Enclosed by silt banks, 24 feet high:	
	1st, 2nd, and 3rd years.	Summer grazing by sheep.
	4th year—has become fresh marsh.	Summer grazing.
	5th to 9th years.	
	10th year.	Ready for ploughing.
	Subsequent years.	Arable.

New salt marsh, outside the enclosures, affords grazing which may be used for fattening both bullocks and sheep. It is flooded normally only at spring tides, but owing to the danger of unexpectedly high neap tides the animals are not left out at night, and after a spring tide flooding the pasture is of little

[1] See note, p. 491.

[2] *Vide supra;* also W. H. Wheeler 'The fens of south Lincolnshire' (2nd ed., 1894). Modern summary accounts, with details of soil analysis and utilization, will be found in G. I. Smith, Lincolnshire (Parts of Holland), and J. E. G. Mosby, Norfolk, in 'The land of Britain' (Final Report of the Land Utilisation Survey of Britain), parts 69 and 70, 1937–38.

[3] See, *inter alia*, M. G. Kendall, "The geographical distribution of crop productivity in England," *J. R. statist. Soc.*, 1939.

use until a good shower of rain has washed off surface salt. Thus unenclosed salt marshes are of limited value.

All observers agree regarding the danger of premature enclosure and reclamation of salt marsh and also of premature ploughing of the enclosed areas. With adequate drainage the land is ready for arable cultivation in ten years and after that is generally far too valuable for other utilization. Thus on the silt lands of Lincolnshire (Holland) the Land Utilisation Survey shows not one field of grass between the margin of the salt marsh and the Roman bank—a belt of land nearly 5 miles wide.

It will be seen that the piecemeal reclamation of the Wash bears little relation to the various schemes which have been proposed for enclosing and reclaiming the whole, nor does the character of the soil in the reclaimed area necessarily indicate the character of that which would prevail over the whole. It is clear however that the Wash could be treated as the Zuyder Zee has now been, by the construction of a main dyke between Hunstanton and Wainfleet. This would convert the Wash into a non-tidal freshwater lake. Three main polders, west, south, and east, could then be enclosed, leaving broad channels for the outflow of the existing rivers and as approaches to the ports. These polders would differ essentially from existing reclaimed land in that they would be below sea-level and dependent on artificial drainage. Such a scheme would add some 150 square miles or 100,000 acres to the surface of Britain. Dutch experience suggests that it might be good quality arable land, but whereas the floor of the Zuyder Zee consists of fine sediment largely of alluvial origin, the floor of the Wash is mainly of marine sands which might afford only sterile soil.

The reclamation of Wash lands has resulted in the addition of very important areas of arable land to Britain. In this there is a great contrast with other parts of south-eastern England, where the reclaimed lands remain almost entirely under pasture. In the alluvial belt of north Norfolk there has been a steady change over the last one hundred and fifty years from salt marsh to fresh marsh, but there is no arable land.[1] Similarly on the extensive reclaimed areas on either side of the Thames estuary there is little arable land. Part of this area has recently been studied by Dr. E. C. Willatts.[2] Extensive allotments for the dwellers in nearby settlements on higher ground and a few market gardens show that excellent crops could be produced under arable cultivation, but the danger of occasional floods and the excellent quality of the pasture have kept this land under grass. Indeed, the old-established drainage ditches which separate the fields have not appreciably changed in the last hundred years. On the other hand the Thames marshes are being steadily absorbed by the spread of heavy industry. It may be urged that the quality of the grassland is such that this change in utilization is to be deprecated and that the loss of good grazing is a loss to the nation's food resources. This seems one of the cases where the needs of industry are so fully satisfied by the waterside location, proximity to the world's greatest market, space for lateral expansion, ease of excavation for docks, etc., that the marshlands must be

[1] Mosby, *op. cit. supra* (1938), p. 191, with maps of utilization in 1795 and 1935.

[2] E. C. Willatts, Middlesex and the London region, 'The land of Britain,' part 79, 1937, pp. 241–4.

sacrificed to those needs. The same applies to the marshlands of the Medway.

The former channels separating the Isle of Thanet and the Isle of Sheppey from the mainland have likewise silted up since Roman times, and are now occupied by permanent pasture. In the case of the Stour, the fall to the sea is insufficient to secure adequate drainage, and so extensive areas of rough marsh pasture result.

Romney Marsh, between the Dungeness shingle banks and the former Lymne–Hythe cliff-line, has been reclaimed by successive embanking from pre-Roman times to 1906. Romney Marsh differs from the reclaimed areas of the Wash not only in that the bulk of the land remains under grass but also in the remarkable variation of soil. As a result the carrying capacity of the marsh for sheep and cattle varies in a remarkable way from field to field, but the whole area is one to be ranked as first-class grazing land. The same applies to Pevensey Level.

Summarizing, it will be seen that land recently regained from the sea has provided Britain with much of her best arable land, some of her best grazing land, some of her best sites for heavy industries, and some of her attractive recreational areas. If the needs of the country in the future are for land for greater agricultural production and an increase of the home food supply, then attention will of necessity be turned to such areas as Chichester Harbour, Langstone Harbour, as well as the great area of the Wash, which are available for reclamation.

DISCUSSION

At the opening of the Discussion the CHAIRMAN (Mr. J. M. WORDIE) said: Before I call upon Mr. Steers I feel sure we should wish to put on record our deep regret at the death of Professor Balfour, who was President of the Society from 1936–38. He joined the Society as a Fellow in 1908 and served for many years on the Council. He took great pride in his election to the Presidency, which marked in a very fitting way the connection of our subject with anthropology. In later years those who knew him intimately were all deeply impressed by the courage which he showed in facing continued ill-health during the last years of his life.

After Mr. Steers, Mr. Jolly, Dr. Mosby, Mr. Borer, and Dr. Stamp had read the papers printed above, the following speakers contributed to the Discussion.

The CHAIRMAN: I will ask Mr. Carruthers, of the Ministry of Fisheries, to add some comments.

Dr. J. N. CARRUTHERS: I am sorry that the invitation to take part in this discussion reached me too late to enable me to prepare a contribution from the particular angle of approach of a student of marine currents. The Lowestoft Fisheries Laboratory sponsors continuous observations upon the water movements past a number of lightvessels situated in the southern North Sea and English Channel. At the moment, thanks to the kind cooperation of Trinity House, we are learning the day-to-day mileage run of the tidal streams in the various directions concerned, past four English lightvessels. We also receive a full record of weather conditions. As a routine matter we work out the residual water flow and residual air flow for each calendar month. The same information comes to us from one French lightvessel, and also from one Danish and four Dutch vessels. Moreover the observations may be commenced at yet other

places. In each case the records of water movement are obtained by means of a current-measuring instrument of extremely robust construction, designed in Lowestoft to work without any intermission whatsoever, no matter how wild the weather or how silty the water. It has been possible to obtain perfectly acceptable data even from a very lively plunging ship. It was important to avoid recording spurious currents really attributable to ship movements, and to obtain continuous records from an anchored steel vessel, from which instruments employing compasses cannot be used at shallow depths. The instrument used has no registering parts under water.

The use of the "Vertical Log," as we call it, is an essential part of the elaborate investigations carried out by the Rijkswaterstaat of The Hague. To give an account of what they do would amount to stating nearly everything which could be regarded as necessary in the study of coastal changes. Dr. J. van Veen, with whom it is my good fortune to be closely in touch, has published an account of researches covering an area of sea wide enough to ensure that nothing is missed which could reveal the origin of the material accreting their coasts and whither goes the material lost. The work includes the following investigations: What coastal changes are revealed by the study of old charts and by the repetition of former surveys? How does the water move at various depths from top to bottom, at all states of the tide, and what is the overall direction of its drift? What burden of silt and sand accurately measured is carried by the water at various heights just above the bottom? How are the soundings changing, what is the nature of the sea-floor (ripples in the sand included), and at what depth can wave influence be instrumentally detected? From sedimentation curves prepared for all sand samples taken (and cores are taken too) it is learnt what is the sand/silt ratio and what is the grain-size composition. Moreover the Dutch put out De Vries sea-bottom pressure gauges even as far as the Galloper and get records of vertical tide from which they prepare formulae enabling them to infer tidal-stream speeds. With cooperation from the English side, they have made penetrating studies of Dungeness and its past and present changes.

My point is to show what could also be done in English waters. I have with me original records taken with the current-measuring instrument in question. The events (in respect of tidal streamings) at the time of the Horsey breach are most illuminating, but they have been published already, and in a new form, this last month. I would like those interested to glance at a whole-year current chart of Dutch origin, and to pay attention to the dates of interest at Horsey. Such charts could be prepared in England. They would not necessarily be of any prospective value in connection, say, with floods, but as a matter of ordinary scientific procedure one should surely have records of elements which are of immediate relevance. For instance, given the initiation of continuous current-measuring aboard a lightship in the Wash, there is no reason why one should not know at all times what column of water was being urged in or was flowing out. In addition the silt and sand burden could be assessed.

I am passing round some small leaflets illustrating a drift-bottle system which we have used extensively and successfully. Every month we use them to keep an eye on the direction of the currents along a line drawn E.N.E. from Flamborough. I would also suggest that the employment of marked coconuts, an old method of ours for studying water movements quite close to the sea-bottom, might interest some of my hearers. We have already traced the off-bottom water movements extensively by means of what are called "bottom-trailing" drift-bottles, and I would recommend to those who are interested in water movements in estuaries a means of investigation which we have in prospect but have not yet used. This is the employment of a dozen or more dhan-buoys

fitted with captive anchors so that they will float for about half an hour and then drop an anchor and cease their travels. These could be put out each half-hour and could be made to anchor themselves in any reasonable depth of water. The anchor-releasing device would be one we have already used successfully in another and much more difficult connection.

Finally, I have with me records showing the nature of the currents off north Norfolk during the heavy south-easterly weather of January when, so Mr. Mobbs tells me, Horsey lost much beach, which was subsequently restored.

Capt. M. O. COLLINS: Most of the speakers have touched on the paucity of records available, and Mr. Carruthers added, perhaps, to the implication by saying that the Dutch landed at Dungeness recently to add to the surveys of the Ordnance Survey.

Speaking from the point of view of the Ordnance Survey, I ought to explain briefly how much has been done—or how little. The large-scale surveys on which anything material in the shape of tide movements could be shown were not started much before 1850. They have been continued since on the scale of 25 inches to the mile. All the topographic detail is shown, of course, and low- and high-water of ordinary tides. We allow a variation of some inches above or below the mean tide, so that having ascertained from the Tide Tables the days on which the tides conform to those figures, the men are then sent on the ground to survey them at the right time.

As far as possible we try to remove any accidental additions or subtractions due to the weather by continuing to work in fine weather, but that is not always possible because a certain area has to be completed within a specific time, and the completion of that area cannot wait for a long period until ideal weather conditions arrive. Furthermore, human nature being what it is, when you have to survey in a short space of time large areas of mud flats I would not like to say that the accuracy is as high as when surveying on more solid ground, where the actual labour is perhaps less and the difficulties under which the work is done are not so great. As a result, generally speaking, the accuracy of our low- and high-water marks, other than on the hard beaches and rocky coast-line, is not up to the standard of the rest of our work. This does not affect the normal public very much, because they are not concerned with it, but it does affect people who are interested in the problem under discussion. They have all, I think, suffered from the divergence of the low-water marks on adjacent sheets. They may not meet, the reason being that they were surveyed under slightly different conditions on varying days.

There is a further point which may be of interest for the future. In the past the Ordnance Survey has carried out its surveys on a cyclic policy; the maps have been revised once every twenty years. That has not proved entirely satisfactory for various reasons, and Lord Davidson's Committee, which sat to consider the future of the Ordnance Survey, in its recently published report recommended that the old cyclic policy be abandoned, and a continuous policy introduced; that is to say, the surveying of the changes as they actually took place. Thus, instead of men being transferred from area to area, returning to survey an area every twenty years, they will remain on the spot and will add the variations to the map as they take place. It seems to me that it might be possible to keep track of the movements in plan of the various parts of the coast when we have observers there. I do not know that it will be possible over the whole of the coasts of Great Britain. It certainly should be possible over a few localized areas, and a certain amount of information of that type might be better than the information available at present.

Mr. S. SWALLOW: Local coastal changes in the shingle foreland of Dungeness

are often rapid. They are of two types: temporary changes varying from day to day or month to month; and progressive, permanent ones. Nowhere in the area is loss or gain of the shore-line uniform; the movement landwards or seawards is very irregular.

There are two coasts to the foreland. North from the Ness are some 4 miles of prograding shore-line, accretion on which is balanced by erosion on the south-west coast. It should be noted that very little of the shingle drifted east from Fairlight (Hastings) in the last 140 years has reached the Ness: it has nearly all been held up by harbour works in the Rother estuary, on the west side of which accretion since 1800 has been almost as rapid as at the Ness itself. The growth of Dungeness to-day, then, is effected not by supplies of shingle drifting up-Channel but by the products of its own erosion on the south-west coast.

I have known the area for several years, and in August and December 1938 mapped by plane-table the coast from Littlestone to the Ness and about half a mile west of it. Half this survey was done on a scale of 1:2,500, and the remainder on 1:10,560. A comparison of this survey with the Ordnance Survey maps of 1878, 1898, and 1908 is interesting.

The growth of Dungeness Point itself has, in my opinion, been considerably slower than that suggested by the evidence given to the 1907 Commissioners on Coast Erosion. The figures there given, considered with my own survey, give an average over the period 1689–1938 of 17·8 feet a year, or a total of 4435 feet. But the ridge about 4435 feet inland had definitely been in existence for a considerable time before 1619, as shown by an early map of Romney Marsh by Matthew Poker. Therefore the shore-line in 1689 was considerably to seaward of that suggested by the average figure of 17·8 feet and the actual growth since 1689 has been much less than 4435 feet.

The shingle extends north from the Ness for about 6700 yards. Accretion along this stretch has been since 1878 inversely proportional to the distance from the Ness. At the Ness the average yearly growth for the period is 14·2 feet; this drops to 7·7 feet some 1300 yards north, and from 2000 to 4500 yards north (where there was considerably less accretion from 1908 to 1938 than from 1878 to 1908) it is between 4 and 3 feet. At the northmost extremity of the shingle growth has been relatively slow, about 1 foot a year. The direction of drift as far as this point is to the north, but half a mile farther north it is southward. Two miles north again it is to the north. This means that the shingle fronting Dymchurch Wall is likely to be swept away by diverging drifts.

South and west of the Ness growth rapidly diminishes: at 66 yards south-west it drops to 6·2 feet and at 600 yards to 1·75 feet per annum; at 900 yards is replaced by erosion with a yearly average of 2·65 feet. This erosion increases westward and is continuous almost to Camber. Defence works can only slacken, and not stop it. Unfortunately, I have not yet surveyed this part of the coast, but comparison of the Ordnance maps shows notable rates of erosion, particularly between 1878 and 1898, when along 4 miles of shore between 5 and 10 feet a year were lost. Defence works however reduced the speed of the sea's advance between 1898 and 1908, and gave figures for the same stretch of coast of from 0 to 4·5 feet.

These average figures may give an impression of uniform advance or retrogression which is very misleading. Two examples will show this. At a point 2800 yards north of the Ness there was an accretion of 220 feet from 1878 to 1908, followed by erosion of 20 feet in the next thirty years; and immediately south of the Ness, on part of the prograding coast, there were losses of 50 and 70 feet between August and December 1938.

I should like to add a few remarks to what Dr. Stamp has said about the area.

In the first place, the crests of the ridges support more vegetation than the troughs. Secondly, there are two industries here: the collection by hand of large blue flints for use in glass manufacture, and the large-scale excavation of the shingle for ballast, transported direct by rail, and for use in building.

Dr. CHAPMAN: There are several features connected with the salt marshes of East Anglia to which I should like to draw attention. Some of these amplify remarks made by earlier speakers in this discussion, but I do not think it will be out of place if they are stressed once again.

One of the characteristic features of a salt marsh is the gradual increase in marsh level due to the continual deposition of silt. If the coast is stable, then I think it is clear that sooner or later the height of the maximum spring tide will limit the depth of mud which can be laid down, and once this state is reached no further growth in height of the marsh will take place. If however the land is sinking slowly, then the depth of mud will be continually on the increase, but the formation of new marsh will depend upon whether the rate of accretion is greater or less than the rate of subsidence. If, in any given area, one can find marshes with a depth of mud that is greater than the vertical height between the level at which marsh formation can commence (which is just above mean sea-level) and that of the maximum spring tide, then it may be argued that such marshes were formed during a time when the land was sinking. In a developing marsh it is of course impossible to use this type of evidence. The salt marshes on Scolt Head Island generally have a relatively shallow depth of mud (up to 2 feet) whilst those near the reclaimed marshes have a much greater depth (13 feet plus), and as their vegetational covering is the same I believe that the old marshes were formed during a period of coastal submergence, and that the younger marshes have been formed during a period of coastal stability. This however does not preclude the possibility that coastal subsidence has started again in recent years.

The second feature to which I would draw attention is the behaviour of the rice grass, *Spartina Townsendii*. Many of you probably know how it has flourished on the south coast, where it has caused the harbour authorities at Poole considerable trouble. It behaves in a peculiar manner on the east coast, where it has been planted. In some places it flourishes, as in the strip between the Ouse and the Nene, where its appearance and spread has saved the local farmers from considerable anxiety over erosion. In other places, such as in the neighbourhood of Brancaster and Burnham, it barely exists. There is a great need for experimental work on the behaviour of this plant on the east coast, if its economic possibilities are to be fully exploited.

After a tour this summer of many of the salt marshes of England and Scotland I am convinced that the economic value of much of the marshland is grossly neglected, especially as many acres are ripe for enclosure, and this is particularly serious in the light of the present situation. Besides those acres that could be enclosed and become arable land, there are many areas, *e.g.* Mersea, Keyhaven, where landowners have permitted sea-walls that have been breached to remain in a state of disrepair, so that once valuable pasture land is again salt marsh. There are strong grounds at this time for the promotion of a survey to ascertain how much land of this nature could be reclaimed or saved. If such an area borders a sandy beach the planting of brushwood is often sufficient to build up the beach and save the marsh temporarily. Ultimate preservation can only depend upon the building of an adequate sea-wall behind the temporary raised beach. This can be illustrated by a marsh at Brancaster, where the beach was built up but the sea-wall behind was not of sufficient height to withstand abnormal gale tides. Considerable erosion has been taking place here for the

last few years, probably due in part to changes of the offshore channels and sand-banks, though it may also be associated with a subsiding land plane.

That changes of channel can bring about erosion and rebuilding is very clearly demonstrated by the terraces, often three in number, to be seen on old marshes in Morecambe Bay and Solway Firth. These terraces can be correlated by maps with former positions of the channels, at any rate in Solway Firth. A small terrace on a marsh near King's Lynn may perhaps be explained on this hypothesis.

Mr. W. V. LEWIS: May I say how pleased I was when I heard of the decision of this Society to hold a discussion on recent coastal changes; and my eager anticipation of the discussion has been amply rewarded by what I have heard this evening. The workers in this country, more perhaps than in any other, should be interested in coastal physiography, and when a Society such as this becomes a pooling ground for the views of different authorities it is making a valuable contribution to the advancement of an important branch of physical geography.

Mr. Steers referred to the regular mapping which has been such an admirable feature of his work at Scolt Head. I should like to see this carried still further. The value of knowing the changes on a coast-line would be greatly enhanced if we knew what weather conditions caused the changes; then we should be able to make a real step towards our goal: the understanding of the factors responsible for the changes. If only the date of the major changes were known one could then get the weather conditions from the Meteorological Office and the current conditions, etc., from Dr. Carruthers. An attempt is being made along these lines at Dungeness, where Lt.-Col. Behrens is arranging to have daily records taken of the changes on the foreshore. A mapping of the sand-banks between high and low water, and beyond the low-water mark if possible, at Far Point, Scolt Head Island, would also be of great value, for the changes in the shingle banks are closely related to the changes offshore about which we are largely ignorant at present.

Dr. Dudley Stamp welcomed the intrusion of bungalows at Dungeness. A small band of workers in the area had very different views at first, but now find that the bungalows greatly facilitate field work by enabling one to live comfortably on the shingle wastes. The spread of the building estates also hastened our detailed levelling and mapping of the ridges. When the levels of the ridges, which have been forming almost continuously for over a thousand years, are fully worked out, they should throw much light on recent changes in the relative level of land and sea.

Lastly, one very minor point which Dr. Dudley Stamp made with reference to plant colonization on Dungeness. He stated that plants colonize the troughs of the ridges and leave the crests bare. This does happen in a few of the deeper hollows, but grasses and most other vegetation colonize the crests first with remarkable regularity. This has greatly facilitated the plotting of the ridges on air photographs. The reason, according to Mr. Pearl, of the Wye Agricultural College, is that the smaller shingle gets colonized first and it is generally found on the crests.

The following written contributions were also received from Dr. J. S. Owens, Mr. I. D. Margary, Mons. J. Legrand, and Lt.-Col. T. T. Behrens.

Dr. J. S. OWENS: Mr. Steers rightly stresses the need for keeping accurate records of coast erosion, and I think some suitable body of observers should be charged with this duty.

I do not agree with Mr. Steers's remark on p. 406 to the effect that cliff falls are attributable to land water, though I suspect that fundamentally we are in

agreement. My point is that unless the sea washes away the debris from the foot of a cliff, falls will ultimately cease; in other words, the sea action is the primary cause and land water only secondary to that.

On the question referred to on p. 407: "Is this piece of coast gaining or losing?" I think this illustrates a somewhat important point. It is not, as Mr. Steers points out, an easy question to answer, but not for the reason he has in mind. The question is incomplete; does it refer to surface area or volume gained or lost? I suggest that, although area is tacitly assumed to be the important thing, it is not necessarily so, and the volume of land lost or gained should receive careful consideration. I think it is certain that, as measured by volume, we are losing land steadily to the sea, although there may be simultaneously a gain of area. Without developing this point further I put it forward as one to be kept in view.

Mr. Jolly refers to the evidence for land subsidence, and a perusal of his paper leaves me with the feeling that the case for continuous land subsidence is by no means conclusive.

One point I suggest for consideration: *i.e.* the possibility of local or even general changes of sea-level due to such causes as a variation in the amount of water held in the atmosphere at any time either as cloud or vapour; changes in the water temperature affecting its volume; or the effect of melting or building up of ice-caps supported on land as on Greenland, the Antarctic continent, and similar land areas. This might have a greater effect than would at first sight be anticipated, simply by adding water to the sea and thereby raising its level. The volume of water represented by an ice-cap 1000 feet thick over a country the size of Greenland would be capable of raising the sea-level by a measurable quantity.

Mr. I. D. MARGARY: As I have made some observations on the erosion in Norfolk I should like to mention certain points for consideration. From 1928 I have taken a series of measurements at over a hundred fixed points along the coast from Sheringham to Eccles with a view to getting an average figure for the loss over a period of years. The measurements are taken from gate-posts, hedge-row junctions, etc., to the cliff edge and, naturally, only afford samples of the rate of erosion along the coast. Taking the mean of the whole series, the results are however quite definite, showing in the two years 1928–30 a loss of about 2 yards per year (not all the points were then under observation), in the three years 1930–33 only 0·5 yards per year, 1933–36 only 0·3 yards per year, but in 1936–38 1·6 yards per year. Of course if more localized means are taken more severe losses appear; thus, for thirty-three points from Bacton through Happisburgh to Eccles, the loss for 1936–38 averaged about 3 yards per year, and the coast there had suffered visibly throughout.

It was suggested that the cliffs are mainly damaged by springs and not directly by sea action. This is largely so between Cromer and Mundesley, especially from Overstrand to Trimingham, where the slips are of vast size, sometimes over 100 yards long and over 50 yards in depth inland, but it is certainly not so all along. The cliffs are often quite dry and vertical, *e.g.* near Happisburgh, yet erosion is rapid and is clearly due directly to sea action.

A point which I had hoped to hear mentioned is the effect of offshore banks on the rate of erosion. My observations tend to show that certain stretches of this coast suffer severely in turn, and wherever this occurs it is noticeable that the lagoon on the foreshore (which on this coast always forms at low tide) at such points lies close inshore, sometimes even touching the cliffs. This was noticeable at Horsey last summer, where the lagoon was actually touching the new defence works at one point. It may be that banks farther out to sea normally provide some protection, and that where these shift or are locally

weakened the wave action is more vigorous inshore, causing the bank and lagoon formation to occur well up on the foreshore with resultant damage to the cliffs. I believe further observation on this aspect might be very fruitful.

I was much interested in the picture Mr. Mosby showed of the church tower on the beach, presumably Eccles. I think he said that nothing of it is now to be seen, but this is not strictly accurate, as large masses of masonry are still visible on the beach (see plate facing p. 415).

Monsieur J. LEGRAND, Ingénieur Civil, Paris: A study of the long-period oscillations of mean sea-level on the North Sea coasts and at Brest provides evidence to suggest that the apparent slow rise of mean sea-level during the last half-century at Brest and at the Dutch and German ports can be correlated to a certain degree with the positive temperature change which has taken place in the sea. The temperature data are scanty, being confined to surface measurements at lightships off the Dutch coast and extending over about thirty years from 1882. The annual means of temperature at these lightships show some correlation with the annual mean sea-levels at the Helder, Katwijk, and Ymuiden, though there are clearly many other influences at work.

In order to bring out a possible correlation with more distant stations, smoothed or overlapping five-year means of temperature at the Terschelling Lightship and corresponding overlapping five-year means of sea-level have been used. There is recognizable correlation between the temperature graph and mean sea-level at all the German and Dutch stations and even at Brest and Aberdeen. In the cases of Ymuiden, Brest, and Aberdeen the influence of temperature appears however to be largely damped out or long delayed by other causes, one of which may be the increased summer melting of polar ice and the consequent influx of cold water. This influence would be propagated slowly from the open seas (Aberdeen, Brest) and would not reach more recessed areas till later.

This hypothesis of thermal change is not advanced to cover all the observed changes of mean sea-level, but suggests that a part at least of the supposed recent land subsidence on the continental coasts of the North Sea and Channel may admit of this alternative explanation. Further data are evidently required, both of temperature and mean sea-level.

Lt.-Colonel T. T. BEHRENS stressed the need for constant observation and recording of coastal change by air photography and other means. With regard to the vegetation on Dungeness, he pointed out that a large part of the crests of the shingle fulls is covered with tall oat grass upon which sheep are left to graze. A considerable amount of work has been done upon the vegetation and the natural vegetational conditions on these shingles, and an account of it will be found in the Annual Report of the South-Eastern Agricultural College, Wye, for the year ending 1938.

Mr. J. A. STEERS: This discussion arose from combining two separate suggestions for papers submitted to the Research Committee. The interest it has obviously invoked this afternoon seems to prove that meetings devoted to various aspects of a problem are well worth while.

I am sorry it is not possible to publish the particularly interesting diagram of wind and tidal conditions that Dr. Carruthers exhibited. Any one who reads this discussion will realize the great amount of light he can throw on coastal problems. It is also satisfactory to hear that the Ordnance Survey hope to adopt a new policy and to keep their surveyors in a particular area. In coastal districts such continuous recording will be of the utmost interest to geographers. I wonder, too, if it is possible to obtain access to the Dutch work on Dungeness: it would be valuable to compare it with that done by English

workers. It is by the correlation of such work that new views and progress are made.

Whilst I agree with what Dr. Chapman has said about marsh development and coastal subsidence in general, I am not, offhand, prepared to subscribe to the view that the deep mud in the old Scolt marshes necessarily implies subsidence. His point is a good one, but I doubt if we have enough information for the whole area to say if subsidence has taken place. A limited number of bores may only indicate pockets of mud and not continuous layers which would, under the conditions Dr. Chapman presupposes, probably indicate subsidence. I may add that a physico-economic investigation of salt marsh areas would be well worth while, but if reclamations on a big scale were recommended, who would pay?

As Dr. J. S. Owens remarks, I hardly think that there is any divergence of view between us as far as his first point is concerned. His second is interesting, and I was content merely to suggest a question with a view to stressing an important matter. I have no figures, but am inclined to agree with his conclusion. His last point is unanswerable here: all I will say is that there is a vast amount of literature about sea-level changes and the Quaternary glaciation. I am extremely glad to have Mr. Margary's figures of erosion recorded, and hope that they may be published more prominently.

In conclusion, I should like to thank the four main speakers who most kindly accepted my invitation to contribute a short paper this afternoon.

The CHAIRMAN: And now it only remains for me to offer thanks to all the experts who have come here this afternoon and provided such an interesting discussion.

AN HISTORICAL AND REGIONAL SURVEY OF THE VILLAGE OF STYAL, CHESHIRE

H. R. McCLURE

THE last half-century has seen a very marked change in the pattern of settlement of the Manchester district. The boom years in the cotton trade, at the end of the last century, were largely responsible for the great influx of population into the area—the workpeople massed together in the present slum properties of Manchester and the nearby towns, and the wealthier people living in the new residential centres to the north of Manchester, such as Worsley, Eccles, and Prestwich. Gradually however at the beginning of this century suburbs began to grow in South Manchester, in places such as Withington and Didsbury. More recently, this suburban development has spread into the country districts of Cheshire, with the building not only of larger houses but also of great housing estates. This has of course only been made possible by improved transport facilities, but, as road and rail services have been developed, the growth of places such as Cheadle, Gatley, Wilmslow, Prestbury, and Alderley Edge has been extraordinarily rapid and has changed them almost beyond recognition.

The village of Styal, situated in this new "dormitory region," remained an anomaly in the suburban development of North Cheshire until a few years ago. This however is in accordance with the whole history of the village, which in many other features has been unique, and it is only now beginning to conform to type. The village is peculiar in that, as a mere collection of isolated farms, it developed little individual identity until the end of the eighteenth century, when a cotton mill was built there and community life started, centred round the mill and its founders, the Greg family. The village then grew rapidly, almost to its present form, in the years following the building of the mill, and was an excellent example of a self-contained community run on an almost feudal basis. To-day however Styal is a village in transition, for it is losing its identity in the face of larger units on all sides: the approach of Manchester, with the building of an airport which lies partly in Styal, has brought a new orientation, while on practically all sides of social and administrative life Styal is becoming merged in a larger community, generally that of Wilmslow.

Styal is situated about 12 miles south of Manchester and about 2 miles north-west of Wilmslow. In 1931, the most recent date for which figures are available, the village had an area of 1510 acres of land and 13 of water, but the boundaries have been changed in the last few years with the changes of local administrative control and the buying of adjacent land by Manchester. For the purposes of this essay however the area within the old boundaries (as shown on the 6-inch map) will be taken. To-day the village has a population of about 1330, which is concentrated mainly along the Gatley–Wilmslow road, the eastern end of Hollin Lane, Moss Lane where the only new houses are to be found, and in the old village centre to the east of Lode Hill; otherwise there are only isolated houses and farms.

The whole region lies between 250–300 feet, with the exception of the

Bollin valley. Geologically, the North Cheshire Plain is composed of Permian and Triassic beds, which are overlain by superficial deposits of boulder clay. In Styal there seem to be traces of receding glaciation, suggested by shallow basins, with rapidly deepening water channels proceeding from them to the river valley, as for example the basin behind "Highfield" now modified by the railway cutting. The earth of these basins is full of ice-worn stones of differing rock formations, and occasionally there are fair-sized boulders, some of which may be erratics from the Shap Fells. Thus the surface geology of the village shows frequent alterations of clays, sands, and marls, tending towards heaviness but largely fertile. The fact that the geology of the district has proved to have economic possibilities is shown by the disused keuper sandstone quarry in the Oak Farm lands which furnished building stone for many buildings and most of the walls of the village, by the modern brickworks on the Wilmslow–Ringway road using the local clay seams, and by the numerous small hollows now containing water and which may originally have been marl pits.

In tracing the history of the village, particular attention will be paid to the agricultural side, for although in earlier years there is little documentary evidence for Styal, its development may be inferred from the conditions known to have obtained elsewhere in Cheshire. In more recent years, documentary and other evidence relating to Styal illustrates economic changes and trends which are probably significant in a more general connection.

Throughout early medieval times Cheshire was probably more heavily wasted than almost any other county, with the exception of Yorkshire. First came the ravages following the inroads down the Irish Channel of the Norse, who then however colonized the area and developed it agriculturally. Later, with the Norman Conquest, Cheshire suffered from being a march-land of Wales and, being on the main route northward, on the west of England, was again laid waste. The Domesday Survey therefore paints a picture of a devastated land, possessing agricultural possibilities, but under-stocked and under-developed. Styal is not mentioned in the Domesday Survey, and it has been suggested that it probably lay in the waste lands attached to the Earl of Chester's demesne of Macclesfield and Edulvintone (Adlington). In the comparatively peaceful late medieval times, Cheshire gradually began to develop agriculturally. Medieval forest rolls, rentals, manorial extants, licences to enclose, pardons for enclosing without licences, and inquisition respecting the right to enclose, all point to the general encroachment of cultivation on the waste. This would obviously take place first in regions free from forest and marsh and comparatively remote from the turbulent Welsh border. The Bollin valley was thus probably suitable for early agricultural development since it was some distance from Chester, and lay between the forests of Macclesfield to the east, Delamere Forest to the west, and the marshes of the Mersey to the north, and the Rudheath Sanctuary and a strip of moorland to the south. The fact that development took place in the Styal area is suggested by an early charter of 1331, one of the first to mention Styal by name, in which the following agreement is made: "To all etc., John, son of Edmund Ffiton sends greeting. Know ye that I have let to farm to Hugh Ffiton, parson of the church of Wilmslow, a piece of my land in Stiale in Pownale for the

erecting thereon a certain grange for the storing of the tenths of the corn of the said Hugh. . . ." This shows that some kind of agricultural community was already in existence.

The growing of crops however was not the chief agricultural pursuit, since Cheshire was, and still is, a pastoral region. It was partly for this reason that Cheshire was one of the earliest enclosed counties; practically the whole of it was enclosed by the end of the sixteenth century. William of Malmesbury wrote of Cheshire in medieval times: "It is barren and unproductive of cereals, especially of corn, as are many parts of the north, but abounding in meat and fish. The natives delight in milk and butter; the rich people live on flesh, and think much of bread made of barley and wheat." Another interesting feature stressed by contemporary writers is the importance of marling; and this gradual improvement and development continued in early modern times. There is no reason to believe that Styal did not remain as a typical farming hamlet throughout this period, and a few farms of to-day date from the late sixteenth century, as for example Oak Farm. With regard to the ownership of the village, the earliest mention of Styal occurs in a Charter, which, although undated, seems from the witnesses to be about 1200 and not later than 1209. "Be it known unto all persons that I, Robert, the son of Matthew de Fulshaw, have granted . . . to Sir Richard Fyton, Knight, all my rights and Lordship of Fulsha, together with the hamlets of Styhale . . ." The village evidently remained in the hands of the Fittons until the mid-fourteenth century, when the lands passed to the de Venables family. In 1409 they were divided, one part passing into the hands of the de Trafford family, who still hold them, and the other to Sir Robert del Bothe. This second area remained in the hands of the descendants of this family until the Earls of Stamford and Warrington sold most of the land in the late eighteenth century to the Greg family.

From various documents in the Pownall Fee Chest, and from contemporary descriptions of agriculture in Cheshire, it is possible to reconstruct the economy of the Styal region during the seventeenth and eighteenth centuries, before the building of the mill in 1787. Throughout this period it seems to have remained a typically agricultural community, occupying scattered farms. It was evidently not of sufficient importance to be mentioned by name on the earlier maps of Cheshire. Saxton's map of 1577, for example, gives Pownall, Ryngey, and Wylmslow in the district and Bowen's map of 1753 gives only Pownall. Burdett's map of 1777 however mentions it by name, and this map is of especial interest in that it was made a few years before the mill was built, so that it is possible to gain some idea of the village before it was changed by the coming of the mill. Only seven centres of settlement are shown by Burdett, but it is not possible to discover upon what basis these were drawn. By comparison with such places as Wilmslow and Cheadle, which are known to have been only small villages at the time, the population of Styal however seems to have been still sparse and scattered. It is thought that at this time some of the caves in the Bollin valley were inhabited by people whose descendants persisted until the late nineteenth century, with a tradition of having lived there for many generations.

So far as agriculture is concerned the greater part of the Styal region was

evidently enclosed and used for agriculture, but there was still a small amount of moorland and areas of unreclaimed marshy ground—Shadow Moss and the adjacent Common of Lindow. This common was probably the last remnant of common land in the area and, to-day still part waste, was not enclosed at all until the end of the eighteenth century. We know that there were common grazing rights as late as 1740, for at this date a bill of sale of household furniture lists among other articles "upon the Common of Lindow, one cow." There was however little common land in the region and, judging from an account of 1810, which probably applied to the late seventeenth and eighteenth centuries as well, the size of the individual holdings was small, probably the greatest quantity of the land being farmed by tenants renting from 50–100 acres. Generally the tenant was restricted from holding more than one-quarter of his land in tillage, since the landlord feared loss of fertility; of the crops produced wheat, oats, and potatoes were the most important. Most farms also had gardens and orchards attached, and cheese-making was of course important though probably not so widespread in the Styal region as in South Cheshire. Marling was evidently still an important feature. The chief type of lease prevalent in the eighteenth century seems to have been the three-life lease, which persisted in Styal until the beginning of this century.

Numerous Constables' Accounts have survived for the seventeenth, eighteenth, and nineteenth centuries, together with various memoranda on such matters of general interest as road mending, etc. These various documents serve to illustrate the mode of life in a Cheshire village in the seventeenth and eighteenth centuries as typified by Styal. But in 1787 came the building of the mill, which was to make Styal unique among neighbouring villages. In documents prior to this date incidental mention is frequently made of wool weaving, and the making of jerseys and hosiery, which was evidently carried on in the farms by hand; cotton too is mentioned after the mid-eighteenth century. Then in 1784 Samuel Greg purchased certain fields adjoining the Bollin, and, three years later, erected the Quarry Bank Mill which is still in the hands of the Greg family and which, still working to-day, is the only survival of a mill of the industrial revolution which has remained unchanged in structure and is still run by water power.

The site upon which the mill was built had various natural advantages. An outcrop of keuper sandstones afforded a firm foundation, and parts of the mill—the boiler house, warehouses, and outbuildings—are hewn out of solid rock. The main advantage however has always been that, situated at the confluence of the Dean and the Bollin, the mill has been able to utilize the strong flow of clear water, at first directly by a large water-wheel, and, for the last thirty years, by a turbine. The flow of water has been increased at different times, first by the construction of a semicircular dam across the river above the mill, which is still standing, and later, in 1817, by the excavation of a tunnel three-quarters of a mile long under the woods between Quarry Bank and Norcliffe Hall, which served to increase the tail-race. A further advantage lay in the fact that the mill was built near an old track, running across the valley, along which pack-horses had carried cotton yarns and woven cloths during the eighteenth century to and from Manchester, outwards to the hand-

loom weavers working in their crofts and cottages and back to the bleachers and merchants. The mill to-day has no rail connections, and for one hundred and fifty years all its trade has been carried on along the one narrow road. There has however been a change in the source of the raw materials, for in the early days the coal was brought from the nearby Poynton Collieries and yarn imported from South America *via* the Bridgewater Canal, while to-day the coal comes from Staffordshire and the yarn from the Royton district.

The nucleus of the labour supply was formed by the hand-loom weavers of the nearby farmsteads, so that from the first probably many of the people of Styal found occupations at the mill. Soon however as trade increased, with the stimulus of the American War of Independence, the Napoleonic Wars, and with the introduction of weaving as well as spinning, it was found necessary to import labour. This included the free labour of whole families and the apprenticing of young children. The original agreements for the binding of these apprentices are still at the mill and show how many of them came from places as far distant as Oxfordshire. Many of the people of Styal to-day are direct descendants of these early apprentices.

It is possible therefore to paint a clear picture of the village of Styal as it was at the beginning of the nineteenth century. From being a scattered agricultural hamlet the village had rapidly increased in size with the building of the mill. Two censuses of the village have survived. The first, drawn up by Finney in 1787, shows how already the population had increased; he lists 71 householders, together with 60 wives, 149 male children, 114 female children, 14 men servants, and 12 women servants, making a total population of 420. By 1801 this figure had increased to 523. In this year a full census was drawn up by a local inhabitant and is of great value, since it indicates not only the size of the population but their various occupations; the householders' names, the number of uninhabited and inhabited houses, the number of each sex and their occupations are given.[1] With regard to the distribution of settlement in the village, Greenwood's map of Cheshire of 1819 showed how it was mainly concentrated in the present village centre, and shows too the rows of workmen's houses which the Gregs built at the beginning of the century to house the imported families. These are still occupied, although now there is one family to one cottage, whereas in the early days there were three in each, one on each storey, so that even the cellars were utilized; they still contain kitchen ranges. In addition, various farm buildings were turned into workmen's houses; in one case a stable was converted into a cottage, which to-day still contains the trap-door through to the original hay loft.

The Gregs also bought a farm to supply the workpeople with farm produce, which they sold at what was then the only shop. The accounts of this shop, made every six months and showing the profit or loss made by the family, still survive, and show how the Greg family controlled the entire economic life of the village. It remained in their hands until sixty years ago, when they handed it over to the people of the village, who ran it on a cooperative basis until it was taken over by the Stockport Cooperative Society a few years ago. The Gregs also built a chapel and installed a minister, a school, an institute for

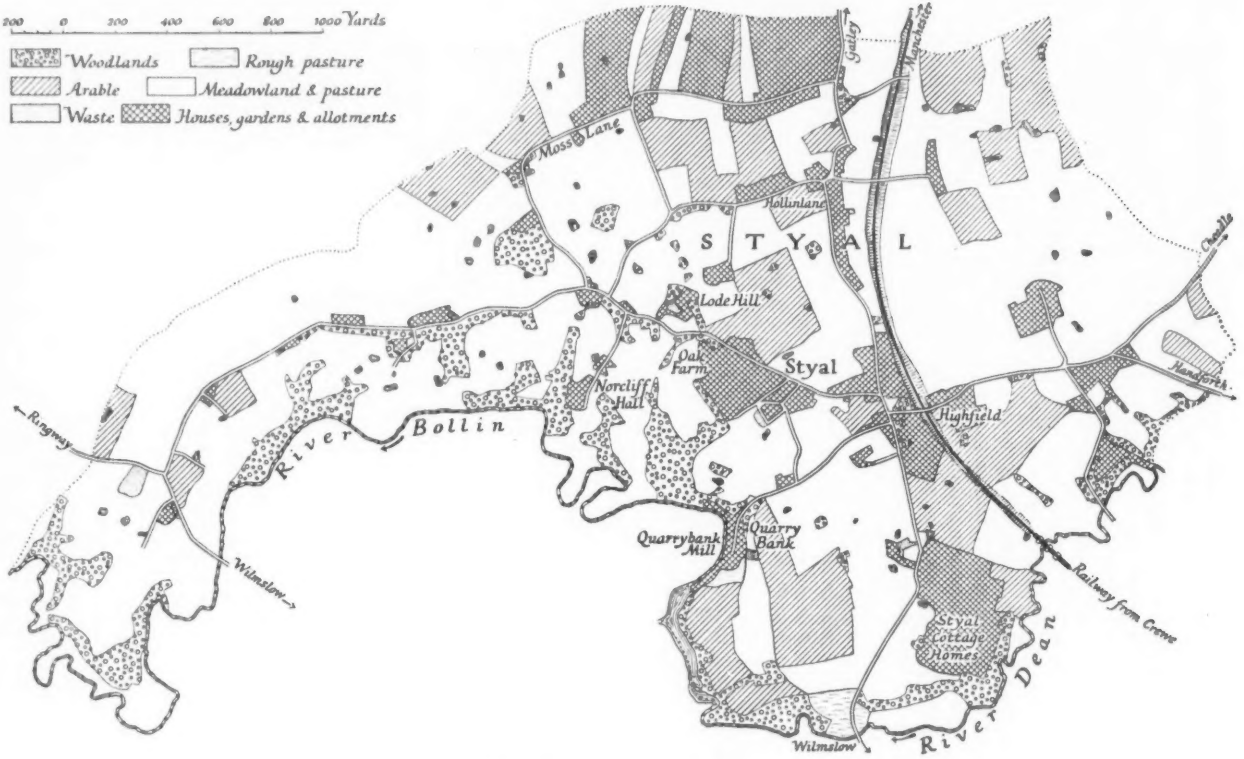
[1] See *Stockport Advertiser*, "Notes and queries," 1883–90 (Pownall Fee Township Documents).

lectures, and an open-air gymnasium. Thus the village developed into an almost completely self-contained unit, for by this time the Gregs had bought the whole of the land of Styal, so that the entire population were either tenants farming their land, or workpeople employed in some capacity at the mill. The Gregs themselves lived first at Quarry Bank House near the mill, but later erected Norcliffe Hall. The complete absence of trade unionism among the mill workers suggests that they were contented, though possibly the more enterprising members of the community left the district. However this may be, it is certain that throughout the nineteenth century Styal was a thriving self-contained community.

The parish documents which survive for this century are mainly Constables' Accounts, but it is known that the three-life lease was still prevalent, and that road-making and mending was a marked feature of the early part of the century. We can only infer that agriculture was carried on as before. Probably practically all the farm produce was absorbed by the population of Styal, and extra provisions had to be imported from outside. As yet therefore Styal had not become dominated by outside markets.

The Ordnance Survey map of 1887 shows that the distribution of population at that date was very similar to that of the present day. Government census returns for Styal alone are available only for 1891 when the population was 827 and for 1901 when it had increased to 1153. This comparatively rapid increase in the ten years between 1891 and 1901 was not however due to natural increase, but to the building of the Styal Cottage Homes (now run as a Children's Open-air Residential School for 600 children) in 1898 by the Chorlton Board of Guardians; and this event may be said to mark the opening of the modern period. The land upon which these Homes are built was sold by the Gregs and purchased by the City of Manchester, who thus obtained a foothold in the village. In 1910 the railway was built, and in the last ten years road facilities have greatly improved. Much new property has been erected in the eastern end of the village, and a brickworks has been built. Finally the Manchester Corporation has bought a good part of Styal for an airport. Internally, the mill has declined, and it will be seen that all these have been disintegrating factors, bringing about great changes in the village.

So far as agriculture is concerned, there have been various changes. The land utilization map shows that the area is still predominantly pastoral, but that there is a certain amount of arable land. The setting up of the Milk Marketing Board has led some of the farms in Styal to become entirely pastoral, as for example Oversley Bank Farm with 120 acres in 1936 under permanent pasture. Others, for instance Oak Farm with about 26 acres out of 100 acres under grass, remain as mixed farms. There is now a considerable area under market and nursery gardens. This is a recent development partly due to the rapidly increasing demands of the neighbouring, growing suburbs of Manchester and specially of the Wythenshawe Estate, which has considerably stimulated the productivity of the surrounding region. Even more important has been the direct demand of Manchester and Stockport markets, made possible by the speeding up of rail and road communications. It was recently stated that the nursery gardens of the Styal Ringway–Moss Nook area alone sent 10,000 tons of produce per year to the Manchester market, which illus-



Land utilization in Styal

trates the importance of this modern development. The average size of these market gardens, situated on the light loamy bands of soil, seems to be about 6 acres, most of them with a considerable area under glass producing mainly early flowers and vegetables. Like the farmers, the market gardeners are all still tenants of the Gregs, but, also like the farms, the land is now leased for much shorter periods, often for only a year, which stands in marked contrast with the old three-life leases.

One of the most important factors influencing Styal to-day is the airport. Manchester Corporation have purchased 664 acres of land altogether, of which 117 acres are in Styal. The site was chosen on account of its flatness, good visibility (since there is little smoke), the general absence of trees, and the ease with which it could be drained. At present the main activity is outside Styal, and no Styal men have been employed in connection with the airport. Its very presence however is bound to have repercussions. Already the farming interest has been threatened by the appropriation of land, and feeling runs high, not only that so much land has been taken, but that such good pasture land should have been selected. Manchester Corporation propose that eventually it shall entirely replace the Barton Aerodrome and plan to link it with Manchester by a main arterial road. This will inevitably bring settlement and involve activities such as Customs Offices. Further, Manchester already owns the area upon which the Cottage Homes are built and the Wythenshawe Estate, and it is said that their ultimate object is to purchase the intervening areas to make one compact block, which the Corporation intend to develop commercially. Plans have been made to set up factories for manufacturing goods such as biscuits and flour, similar to those already built on the outskirts of Wythenshawe. The factories are to be on the land near the railway, so that they will be able to utilize rail transport, while the land on the western side of the Gatley–Wilmslow road is to be developed as a residential centre. These plans have not been definitely passed, and they do not embrace Styal as yet, but they are illustrative of probable future development, coming right up to the boundaries of Styal.

So far the purchase of land in Styal has not made any difference financially to the tenants, since they are paying the same rent to the Manchester Corporation as they used to pay to the Gregs, and they were compensated for the actual loss of land by arbitration. But, should the whole area come under Manchester, the rates would inevitably be much higher, and it is because of this threat from Manchester that Styal has placed itself under the Wilmslow Urban District Council, though such a move has inevitably resulted in the loss of much of its individual identity and self-contained character. A further minor disintegrating influence may be seen in the brickworks which, built ten years ago, own 60 acres of land and produce 12 million bricks per annum, using the heavy and comparatively lime-free clay seams. The works are increasing and modernizing their equipment to-day, and of the forty men employed none comes from Styal itself, which again illustrates the break-up of the unity of the village.

Finally, perhaps the most fundamental influence in modifying the life of the village has been the decline of the mill. To-day it is barely still running; even between January and March 1938 the number of employees declined

from about fifty to fourteen, of whom ten are girls, the majority from Styal. Out of 440 looms only a few are working; spinning has been entirely given up and the only goods produced are a small quantity of laundry cloth. Thus, after one hundred and fifty years of continuous production, this unique water-driven mill is on the verge of closing down, and the *raison d'être* of the village for a century and a half has almost ceased to exist. The majority of the population are forced to look outside the boundaries of Styal for their livelihood. A certain number, in addition to the market-gardeners and farmers, still work in the district as chauffeurs and gardeners, especially at the Cottage Homes, but these are mainly the older generation. To-day practically all the young men work in Manchester, for this has been made possible by frequent train and bus services. Thus only the older inhabitants still retain their village loyalty. The influence of the school is also diminishing, as the older children already go to Wilmslow.

Finally, the head of the Greg family no longer lives in Styal, so that, although all the land is still in the hands of some branch of the family there has inevitably been a loosening of ties between the lord of the manor and his people, and an almost complete disappearance of the feudal system which existed in the last century. Thus the village, without the ties of church, mill, or school, is rapidly changing its character in the face of external influences. The farming interest of the village is still thriving and it forms an example of a typical landlord's village, with a complete absence of owner-occupier. Yet, in spite of the Gregs' determination to retain the land, outside interests have already succeeded in obtaining a footing by compulsory methods, and the disappearance of personal interest in the administrative life of the people is thus an inevitable result of the absorption of Styal in a larger unit.

Yet there is one factor which may save Styal. In May 1938 Mr. A. C. Greg, of Norcliffe Hall, presented the actual village, together with the Mill and Apprentice House, and about a third of a square mile of farmland and woodland, along the banks of the Bollin, to the National Trust. Thus the future of a part of the village at least seems to be assured. This is particularly fortunate in that Styal, because of its unbroken tradition of agricultural prosperity, the running of the cotton mill, and its self-contained economic character under a "feudal" system during the nineteenth century, is perhaps unique.

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The Council have awarded to this Essay the annual prize offered for an Essay of not more than 5000 words. The conditions of the competition for 1940 will be announced in the July Journal.

TWO WATERFALLS IN BRITISH GUIANA

PAUL ZAHL

I LEFT Georgetown on December 5 in a seaplane piloted by Mr. A. J. Williams. Our first stop was at Tumereng, on the Mazaruni, where we picked up 600 lb. of baggage and equipment, and then we set off with the hope of landing as near as possible to Mount Roraima, the 8000-foot mountain at the tri-junction of the boundaries between Brazil, Venezuela, and British Guiana. As we approached Roraima the river became dotted with cascades and was very rough. The closest we could reach was at a point about 50 miles from the mountain on the upper Mazaruni near its confluence with the Kamarang. A party of Indians took us in corials up the Kamarang to the Mission at Waramadong. We spent a few days at the Mission engaging Indians to accompany us to Roraima. From Waramadong we moved on to the Mission at Paruima, and then across the Uitshi river, a tributary of the Kamarang, on to Roraima by way of Venezuelan territory.

After climbing to the top of this great mountain we took a new route back to the Kamarang, to investigate some waterfalls whose noise was heard echoing through the forest. We camped with a party of Arekuna Indians who had their village in a remote valley. From our own interpreter we found that they had never before seen a white man. They also had heard the roar of a great waterfall but had never seen it. From the Arekunas' camp I organized a small party of two Indians and myself, and we followed the river into the gorge. Up the valley the sides closed in and became very precipitous. About half a mile from the base the fall was still invisible, but the noise became almost deafening and the walls perpendicular.

We finally came out into a clear spot, and looking skywards I saw the brink of the fall; because of a promontory I was not able to see its base. It was raining heavily and photography was almost impossible. Finally I climbed to a steep bank, clinging to shrubs and vines, and by hanging on with one hand and operating my camera with the other, I was able to secure a good photograph. I had no way of estimating the height of this fall, but by comparison with the one discovered later on the Uitshi, a branch of the Kamarang, I judge that they fell from much the same height.

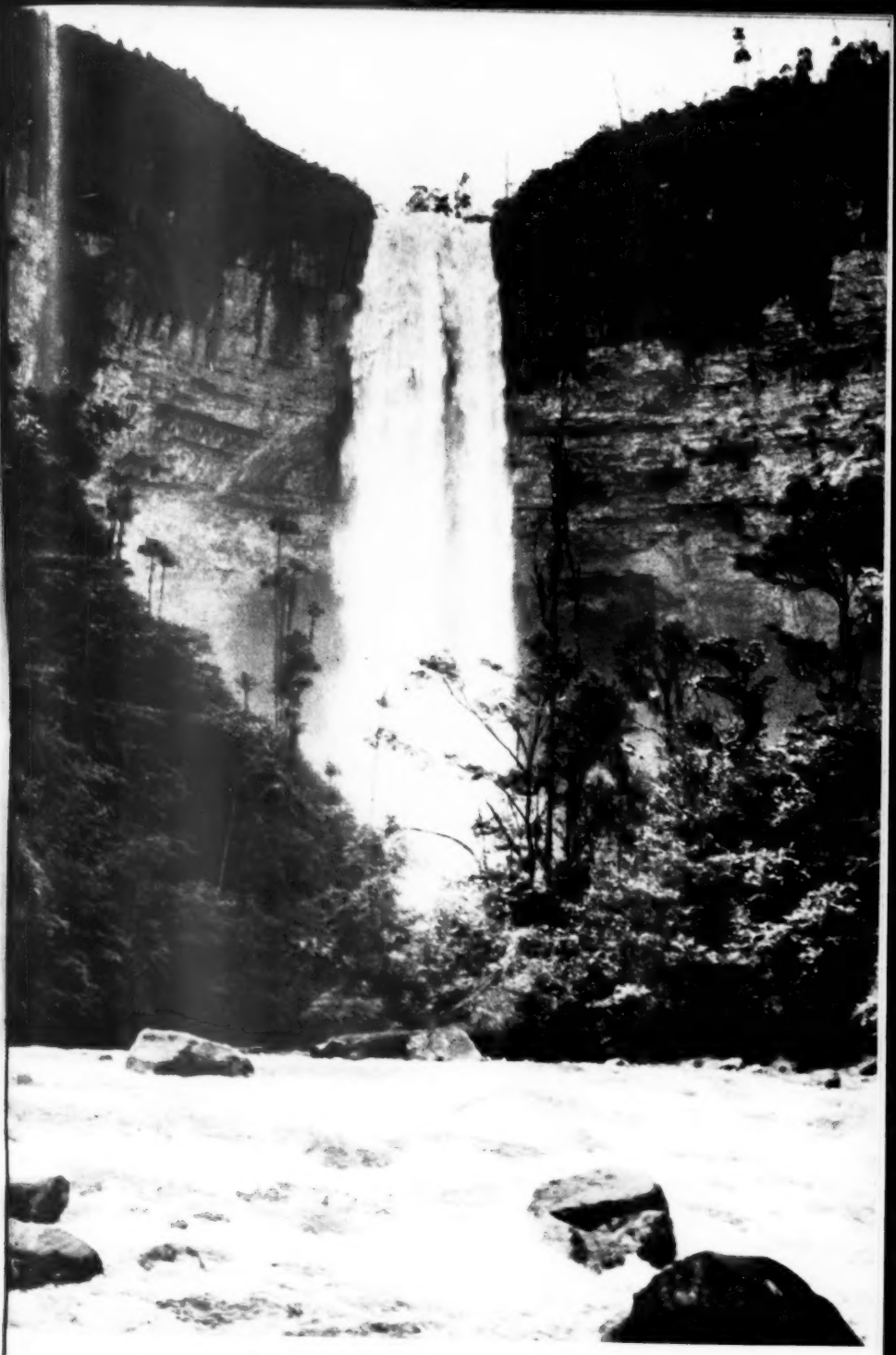
Leaving the Kamarang we moved up into the gorge of its tributary, the Uitshi. It was easier here. We not only looked from below, but were able to climb to the brink and make a very careful study of the fall. Fortunately the river was fairly low, at the end of a dry season. The width of the Uitshi at the brink was between 150 and 200 feet. I estimated the height of this fall in several ways. I threw large rocks over the brink into the chasm, watching them carefully and timing their period of fall. It took on the average ten seconds for a large rock to fall from the brink into the chasm below. Applying Galileo's laws of falling bodies we calculated that a rock takes 10 seconds to fall 1600 feet.[1] These calculations were later supported by Professor Pilgrim, of Queen's College, British Guiana, on my return to the City.

[1] In a vacuum: less in air.—Ed. *G.J.*

At the brink the trunks of fire-denuded trees were 75 feet to 100 feet in height; they can be seen in the photograph. Using this observation in subsequent studies of photographs the height of the fall appeared well over 1000 feet. For a third test, after returning to Tumereng to meet the seaplane, I engaged Mr. Williams to fly over the falls so that I could secure motion pictures. Mr. Williams, who had seen most of the known waterfalls in the hinterland of the colony, agreed that the Uitshi fall was well over 1200 feet and comparable to Kaieteur in magnificance. Accompanying us on the trip by air was Mr. G. T. Chislett, formerly a transport officer with the British Boundary Commission, and who had also seen many large waterfalls in various parts of the colony; he agreed that the fall was much higher than Kaieteur.

The Kaieteur fall carries a slightly larger volume of water, but the Uitshi has a greater and also perpendicular drop direct into the chasm below, and can therefore be classed with it, and with the Victoria and Niagara falls.

Between the Uitshi and the Kamarang I had the pleasure of seeing another gigantic fall, on another tributary of the Kamarang, which poured over the escarpment, cascading twice over boulders. I gathered later that it was most probably the Ataburau-Wena, which was discovered by a Jesuit missionary in 1919.



Fall on the Uïtshi river, British Guiana

Hunlen Falls, British Columbia

THE HUNLEN FALLS AND TURNER LAKE IN BRITISH COLUMBIA

DON MUNDAY

A NOTABLE but almost unknown waterfall exists in Bella Coola valley in British Columbia. This valley forms a deeper trench through the Coast Mountains than the better-known Fraser river canyon. Although Bella Coola river is fed mainly by glaciers of the Coast Mountains, its headwaters have cut gorges of considerable depth even where they extend into the lower plateau country on the inland side of the mountains. It is the flank of one of these canyons which permits this remote waterfall a clear leap of 830 feet. The falls, which are to be known officially as the Hunlen falls, are believed to have been first visited by George Turner, a trapper, in 1909. Walter and Frank Ratcliff saw them in 1910, and named them after Hunlin or Honlin, the Indian chief whose trapline had been beside the falls before white men took possession of it. Since then not more than a score of people have come within sight of the falls owing to their inaccessibility.

I made two visits in the summer of 1938. T. A. Walker and George Draney, outfitters at Tweedsmuir Lodge 40 miles up Bella Coola valley, had a fishing party to take up the Atnarko branch of the river. I accompanied the party along a horse trail, about 50 miles long, which extends eastward to Anahim Lake, and is the Bella Coola valley's only link with provincial highways. It more or less follows an Indian footpath which was ancient when white men began using it about 1863 to reach the Cariboo goldfields. The several hundred settlers in the lower part of the valley depend on coastal steamers for communications. Where the main trail turned east up Hotnarko river, we turned southward by an increasingly rough trail up Atnarko valley, being forced to skirt loose talus slopes where floods had ravaged the valley floor. This trail serves one settler who, with his family, seems to have sought complete seclusion beyond Lonesome Lake; below the lake was a further barrier, "The Stillwater," a flooded area about 2 miles long. A recent outwash of boulders from Goat Creek had deepened the flooded area to a lake bristling with willows and cottonwoods.

This unforeseen submergence of the meadows so reduced pasturage for the horses that our stay had to be cut short, but I was able to make a hurried trip in a small inflatable rubber boat to within sight of Hunlen falls. Without guidance I succeeded in tracing the crooked original river channel without getting astray among the thickets. There are probably more grizzly bears in Klinaklini and Bella Coola watersheds than anywhere else in British Columbia, but I avoided any direct encounters.

The boulder fan from the falls is the dam creating Lonesome Lake, the debris consisting largely of material from the canyon cut by the falls. The falls drop directly from a lake occupying a valley parallel to the Atnarko, and about 2000 feet above it. Like many other valleys in the Coast Mountains, the Atnarko valley walls exhibit something similar to the exfoliation structure parallel to walls and floors of U-shaped glacial valleys in the Sierra Nevada of

California, which François E. Matthes interprets as caused by "dilation of the granite following unloading brought about by rapid glacial erosion."

By climbing the precipitous face of the spur between Atnarko river and the torrent from the falls, I gained a knife-edged ridge nearly level with the top of the falls which, due to a bend in the gorge, faced me directly. This is the only place, except the difficult and obviously unsatisfactory canyon bed, permitting a view of the full height of the falls. No extensive snowfields feed the falls. No doubt their flow was less than normal, 1938 being an unprecedentedly dry year.

Local usage establishes the name of Turner Lake for the source of the falls, and according to popular belief there is danger of a sudden collapse of the cliff causing the lake to deluge the Bella Coola valley. Rapid erosion of the gorge is doubtless mainly due to spray freezing in crevices. The falls tend to undercut the cliff, parts of which literally overhang; the nakedness of the walls is contrasted with the wooded shelf which forms the brink. Otherwise the setting of the tremendous column of spray is of unrelieved severity.

Attempts to reach Turner Lake with horses had failed in recent years, but Ratcliff thought he knew a practicable route, and it was decided that my daughter and I should accompany him. It had to be a somewhat hurried trip, and as no considerable pasturage was known along the lake, it was thought well to take only one pack-horse and no saddle horses. Zigzagging 4000 feet up a steep trail, we gained a remarkable shelf running along both flanks and the north end of the range of mountains between the northward-flowing Talchako and Atnarko rivers, which unite to form Bella Coola river. We were to cross this range, here about 8000 feet high and carrying small glaciers. Southward it attains 11,714 feet at Monarch Mountain.

Views from this shelf are magnificent and reveal the four types of glaciation recognized in British Columbia: alpine, intense alpine, mountain ice-sheet, and continental ice-sheet. The general profile shows a slope towards the Interior Plateau, but the drainage system is reversed and carries the water westwards through the Coast Mountains. It has been suggested that the trunk valleys antedate the uplift of the Coast Mountains. If they did not cut down as fast as the mountains rose, they were later eroded to, or even below, base-level by ice on its way to the sea from the inland slopes of the range. Westward for 20 miles we saw the U-shaped Bella Coola valley, flanked on the south by jagged glacial peaks rising to more than 9000 feet above the river: one of these is the "stupendous mountain" described by Sir Alexander Mackenzie when making the first crossing of North America in 1793. Most of these mountains (unmapped) appear to be granitic, but when making the first ascent of Mount Stupendous in 1937 we found a thickness of at least 8000 feet of stratified rocks (felsites and andesitic tuffs). The north wall of the valley (granitic) rises even more abruptly, but at about 4000–5000 feet flattens off and rises about 2000 feet more, still with a concave outline, to rounded ridges (Triassic volcanics) without permanent snowfields even on their northern slopes. It suggests a deep U-valley cut along one side of a broad older valley which had been given a saucer-like cross section during periods of maximum ice-flood. The Talchako valley has a very similar cross section,

but the true right wall is higher. Talchako glacier is believed to ascend to about 1500 feet. Henry S. Hall partly explored it in 1935 and reports it to be 15 miles long. In comparison with other Canadian mountains in the same latitudes, the Coast Mountains are still undergoing intense alpine glaciation, though rapid recession is the rule at present. For instance, Klinaklini glacier, near the head of Knight Inlet and west of the Mount Waddington district, was explored by Mr. Hall, my wife, and myself, and found to have a maximum length of 35 miles and an area of 300 square miles; it descended to 475 feet above sea-level.

We travelled near or above timber-line (about 6000 feet) through the range eastward to the Atnarko slopes, until we could look down on the shelf already described. Here it took the form of a shallow high-level valley occupied partly by Goat Creek and partly by the valley draining over Hunlen falls; but 10 miles above the falls it had become definitely a diverging valley turning back south-west into the same range we had just crossed. We descended steeply 1500 feet into a branch of Goat Creek. In the wet valley bottom peaty meadows are steadily invading and killing the forest. Beyond this we had to chop a path through tall jackpine forest which was still barricaded with fallen trees killed by fire, probably more than half a century ago. The ground was rough morainal mounds and outcrops of glaciated rock. In three and a half days from Tweedsmuir Lodge we covered a straight-line distance of about 16 miles to a camp within about 250 yards of the brink of Hunlen falls, and near Turner Lake.

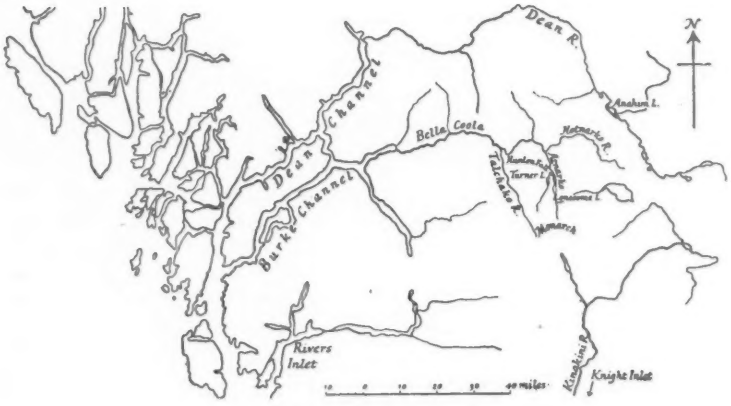
The lake trends north and south; swampy hollows parallel it between moraines and low rock ridges scarred by northward-moving ice. The river turns eastward through a broad hollow, at once tumbling about 15 feet down granite stairs to a wide step; smooth and green, it drops from the clean-cut edge for 830 feet; at this stage of the water it began the plunge as two streams. Flat rocks along the brink enabled us to see into the chasm, but a bulge of black rock cut off most of the lower 250 feet. The crests of both walls of the gorge rise as they run away from the falls, and the lake evidently once had a higher level. There was little to suggest likelihood of a rockfall which would release lake waters at a rate which would prove destructive to people in the Bella Coola valley. The 7-mile-long lake is reputed to be deep, but the angle of its shores does not suggest great depth. By aneroid, the height of the lake is about 3500 feet.

By searching for the more sparsely forested crests of moraines and rock ridges we advanced the trail about 10 miles in six days. On reaching the southern end of Turner Lake we discovered that the valley became one of the great "through" valleys such as Dr. Victor Dolmage found at Chilko and Tatlayoko lakes (Canadian Geological Survey, Summary Report, Part A, 1924). With less than average river gradient the valley cut through the range to Talchako valley; several lakes, from half a mile to 3 or 4 miles in length, occupy the upper valley which is about 12 miles long. Adjacent mountains probably are capped with Triassic volcanics, but local glaciers were incapable of eroding a valley 4000 feet deep and a mile across its floor. At the present time Talchako glacier is distant about 2 or 3 miles from the head of the through valley and about 2000 feet below it. During the period when this

glacier piled moraines 500 feet high near the Bella Coola forks it doubtless thrust an overflow tongue through the breach to Turner Lake.

Much canyon cutting certainly takes place sub-glacially, particularly at the lips of hanging valleys, and the Hunlen gorge may not be entirely post-glacial. There is a dry branch of the gorge which we did not have time to visit on our hurried homeward trip, but it may be a channel left dry by a lowering of the present outlet.

The maximum depth of ice in these valleys of the Coast Mountains is not yet fully known. LeRoy placed it at not less than 5000 feet in Jervis Inlet. Along Talchako valley we found striations and erratics at 6700 feet, but there is little doubt that ice over-rode mountains 8000 feet high. West of Mount Stupendous westward-moving ice left granitic erratics at 7200 feet on top of a north–south felsite ridge beside Bella Coola valley.



British Columbia

MOUNTAIN DEPOPULATION IN ITALY

LO SPOPOLAMENTO MONTANO IN ITALIA. Indagine geografico-economico-agraria; a cura Com. Geogr., Cons. Naz. Ricerche [Pubbl. VII[8]] e dell' Ist. Naz. Econ. Agraria (Studi e monogr. N. 16). VIII. Relazione generale. By UGO GIUSTI. *Roma*, 1938. $10\frac{1}{2} \times 7\frac{1}{2}$ *inches;* xxvi + 248 *pages; maps and diagrams.* L.30

THE publication of this volume marks the conclusion of a long and thorough research on a question of great social importance not merely in Italy but wherever high mountains stand adjacent to populous European lowlands. The formerly self-contained economy of well-peopled mountain valleys has been broken into by improved communications leading to greater knowledge of the lowlands with their economic and social attractions; hence the exodus of surplus population, or at least increased seasonal emigration, and in the valleys themselves a general movement of the inhabitants to lower levels. The highest hamlets, formerly occupied permanently, now serve as summer quarters or as temporary resting-places for the early hay-making, or they are totally evacuated.

The Italian National Committee for Geography, at the instance of the National Institute of Agrarian Economy, set itself to discover the intensity of this depopulation throughout the Italian Alps and the northern and central Apennines, and to study its character and causes. Detailed studies already published contain a vast amount of material bearing upon the geography of man in these mountains, and this summary volume is largely devoted to the statistics which can be fully appreciated only when read in conjunction with these regional and descriptive works. The relative importance however of the various aspects in the movement of population can be clearly seen in five large-scale and coloured cartograms. The main text by Professor Giusti is written round voluminous statistics, and is prefaced by a short geographical introduction by A. R. Toniolo summarizing the physical conditions of environment in each region, and some of the human reactions as well. Professor Giusti has supplemented his general statement with summaries of the findings of the investigations, which took place from 1932 to 1938 during years of considerable economic difficulty in Italy.

While the degree and the date of incidence of depopulation vary greatly, the causes in some ways are the same. The increased knowledge of the attractions of the outside world has been made effective by economic crisis and lowered price-levels. Moreover the observers examining the local causes of emigration and unduly low standards of life report certain conditions so frequently that they may be taken as typical of large tracts of both Alps and Apennines. Disorganized water systems, neglected pastures, and excessive deforestation are phenomena that obviously call for unified remedial action. Forestry conditions are frequently mentioned as closely related to the rights of the mountaineers, and it is clear that the campaign against the goat as a danger to trees has had its repercussion upon the well-being of his owner. Like the pastures the domestic animals need attention, and methods of breeding and maintenance could be improved; similarly the production of eggs and of honey might be encouraged. The differences of prices prevailing in mountain and plain are often stressed, though it is not clear how these are to be equalized. Main roads are generally good, but better subsidiary routes are needed. This affects not merely the normal pursuits of the people but also the tourist industry, which could be greatly developed; and it is interesting to note that it is not the large hotel which is

wanted but an abundance of small establishments and also summer lodgings. Here the Tirolese have shown the way, and their greater domestic comfort is an example to follow, for the state of hygiene throughout many of the regions can be greatly improved. The reopening of the little schools at many of the hamlets is often recommended; likewise the reduction of local taxation, or at least some change in its incidence. The finance of regeneration however was not the business of the Committee; it is clearly a matter for the central government, and one author suggests the creation of a ministry for the mountains. An almost universal difficulty arises from the excessive subdivision of property under the inheritance law; very cautious experiments are recommended, again with the region of Upper Adige as a possible model.

It will be of interest to give some idea of the special troubles of the regions.

The western Alps, almost everywhere from Monte Rosa to the sea, have seen decline in population and also in birth-rate since 1871, with the most intensive depopulation in the more arid part south of the Dora Riparia; here the permanent emigration in fifty years varies from 30 per cent. to 40 per cent., with the maximum in the Cottian Alps, and the average birth-rate decline is over 50 per cent. This western mountain belt is narrow, and rises abruptly from the plain; important routes penetrate it to France and Switzerland. The contrast of economic levels here with those of the plain and across the frontiers has long been known and appreciated by the mountaineers, not merely on account of topography, but because of community of language on the two sides of the Alps. Other causes of depopulation were the ending of real cooperation between the Alpine and the foothill zones resulting from the great agrarian changes in the latter; the phylloxera epidemics; and, paradoxically, the restrictions on emigration leading to secret movements over the frontiers of emigrants who dared not return.

The Lombard Alps exhibit greater physical variety with the zone of limestone Pre-Alps attaining a width up to 40 kilometres, and the phenomena under study are also more varied. West of Lake Maggiore conditions resemble those above described, the two railway routes and the invasion by the silk industry representing special causes of mountain depopulation. Somewhat similar is the position in the Bergamese Alps. The rest of the Lombard Alps show no comparable decline in population, though the region is described as one of "potential depopulation."

The provinces of Trento and Bolzano present great contrasts for which there are, of course, important historical and geographical reasons. From structural, orographical, and climatic causes the northern province is much the better fitted to support rural population in comfort. In the province of Trento the cultivation of vines and silk-worms led to rapid growth in population during the first half of the nineteenth century. Economic crises and war devastation have affected these and other agricultural occupations, and the development of a tobacco industry, of orchards, and of tourism has not sufficed to counter the intensification of misery in a region where the standard of life was already low. The province of Bolzano, on the other hand, shows no tendency to depopulation. The social and economic unit is the family group of from five to twenty persons, inhabiting its isolated wooden farm with a land tenure and inheritance system that avoids the excessive subdivision of land. Dependent mainly upon products of forest and pasture with which they are well endowed, the Tirolese have weathered the storms of the post-War period.

In the Venetian and the Julian Alps the greater nebulosity and rainfall brings vegetation and habitation limits to lower levels than elsewhere. That legislation does not pay enough attention to geography is instanced by a law of 1923 which

favoured mills situated above 800 metres, although the mills in these mountains are usually below this altitude: a fact which emphasizes the large area that is unsuitable for agriculture. Outward signs of depopulation are rare, but with poor soil, decadent pastures, and inferior stock there is a tendency to evacuate which only marked economic change can prevent. In the Julian Alps tillage is of even less account than farther west, while lumbering, a leading occupation, requires fewer local hands now that animal transport has given place to mechanical, performed by outsiders.

Decrease of population in the northern Apennines began only about 1927, and as yet it is not serious. Rarely do families emigrate, but the young adults are now doing so. The dis-equilibrium commenced after the War, but was largely concealed by excessive wood-cutting and extension of pastures which kept men occupied. In certain districts landslides are a chief cause of real depopulation. From the Abruzzi in the central Apennines we have a description of mountain life at its hardest. Here a remarkably contented and virile people continue to exist in wretched conditions, striving to produce grain at heights above 1400 metres, with quite insufficient animals, and scarcely enough wood to maintain fires during the long winter. Yet evidently even the Abruzzi highlanders are beginning to feel that they would like some share in the "integral improvements" of which they have heard. A. G. O.

REVIEWS

EUROPE

THE GROWTH OF MODERN ENGLAND. By GILBERT SLATER. Second edition. *London: Constable and Co.*, 1939 (*first published* 1932). 9 × 5½ *inches;* xviii + 642 *pages; diagrams and maps.* 18*s*

This book had its origin in a well-known study, 'The making of modern England,' first published in 1912 and issued in a revised and enlarged edition under its present title twenty years later. The present edition was in preparation when Dr. Slater died in March 1938, and before his death he had completed the revision of the text. The main theme is "the inevitable interaction of politics, economics, and ethics in social developments and changes," and the period covered extends from the beginning of the eighteenth century to about 1931. This is not dealt with uniformly, for the survey of the eighteenth century is confined to the main social and economic developments and forms in fact something of an introduction to the fuller treatment of the nineteenth and early twentieth centuries.

A book of this type can be judged on its proportions and its accuracy. As regards proportions much space is given to social and economic change, to the progress of education, the growth of the labour movement, and the development of government, both national and local. The proportions are well indicated by the fact that the chapter on "The rise of feminism" is longer than that on "Foreign affairs and national politics" during the last half-century. This does not seem unjust considering the aim of the book, which is not to supply the sort of information found in any text-book of political history. As regards accuracy there are a good many statements which appear to need correction or modification. Rather surprisingly, these are most common in the economic sections.

Thus the account of enclosures (p. 47) appears unnecessarily heretical, through a failure to distinguish between old enclosures of before 1500 and the enclosures of the sixteenth century. The Corn Law of 1689 is said (p. 37) to have come "very near to decreeing starvation for the labouring classes in case the harvest failed," but no mention is made of the duties on imported corn being discontinued in times of scarcity. Nor was the bounty on corn abolished in 1773 (p. 127), for the Act of that year merely modified the bounty, which did not finally disappear until 1814. The Statute of Apprentices (1563) was not in general modified by 1 Jac. I, c. 6 (pp. 78, 218), for the minimum wage clauses of the latter applied only to workers in the woollen industry. The Acts of 1701 and 1721 prohibiting the wearing of certain printed cloths (p. 53) did not apply to muslins. It seems scarcely correct to say (p. 63) that "elsewhere than in Durham and Northumberland the sale of coal was restricted to local markets" when coal from south Wales was shipped as far as Exeter and even on occasion as far as Great Yarmouth; or that Lombe's silk mill provides (p. 71) "the first example in England of power-driven machinery in any textile industry" when the antiquity of fulling mills is remembered. Such errors, and others like them, are perhaps almost inevitable in a book that deals with everything from turbines to Tractarians, but they do detract from its value. T. S. W.

WEST CUMBERLAND (WITH ALSTON): a survey of industrial facilities. By G. H. J. DAYSH. *Whitehaven: The Cumberland Development Council*, 1938. 11 × 8½ *inches; 176 pages; illustrations and maps*

This survey of the West Cumberland Special Area in the main follows the lines of an earlier survey carried out for the corresponding organization in north-east England.

It contains a summary of the mineral resources considered in terms of the geological subdivisions, detailed information concerning transport and public utility services, a careful analysis of the labour supply available, and a special memorandum on the present economic position of the leading industries. It will provide detailed and authoritative information for industrialists establishing undertakings in the area. The excellent treatment of the port activities and changes in their relative status will be of special interest to economic geographers, and it may be noted with satisfaction that the survey, having been carried out by a geographer, is adequately illustrated with distribution maps.

The essential characteristics of the industrial life of this Special Area are well brought out. Its prosperity depends upon a limited range of basic heavy industries: coal-mining, the extraction of haematite iron ores, and the manufacture of pig-iron and steel. These are in large measure interdependent, for the local iron and steel industry consumes most of the ore and about one-third of the coal. Coal-mining further depends to a considerable extent upon shipments to Ireland. For some time past these industries have been contracting, although steel-smelting has recently expanded as a result of rearmament. Much unemployment in the Area, as well as considerable migration, has resulted. The consequent desirability of widening the industrial basis by the attraction and development of new and especially of light industries is stressed, and the possibilities are carefully examined in relation to the natural resources and industrial facilities available. But the main disability of the Area is underemphasized. It is an outlying industrial region, somewhat isolated from the main concentrations of population and economic arteries of the country by distance and the disposition of physical features. Although it is not without many features favouring new industries, the small local market and the position for distribution over the national market put it at a severe disadvantage in competing

effectively with other more focal centres in attracting light industries. The light industries that have grown at Carlisle, far from indicating the general suitability of Cumberland, reflect the significance of distribution facilities, in respect of which Carlisle is so much better endowed than West Cumberland. A. E. S.

THE ALPS IN 1864: a private journal, by A. W. MOORE. Edited by E. H. STEVENS. *Oxford: Basil Blackwell*, 1939. 8×5 *inches; in two volumes:* xxviii+246 *pages;* xii+247–524 *pages; illustrations and maps.* 5*s each*

This book is among the mountaineering classics of the last century. It was originally printed in 1867 for private circulation, and copies of that edition are much coveted by collectors of Alpine literature. In 1902 it was published at 36*s* by David Douglas, of Edinburgh, and edited by Professor Kennedy.

It was written in diary form, and its chapters and paragraphs are arranged by the editor. It describes, in straightforward, unaffected language, the author's adventures in the days when the Alps were yet unspoiled by commercialization, when their inhabitants were leading natural peasant lives, and when the Alpine mountaineer was an explorer rather than a gymnast. It is a time that all climbers like to read about, and Moore's simple, sincere account of his adventures helps us to regain a sense of proportion that nowadays is often lost. Nevertheless, although in 1864 mountaineering was still in its infancy, and though climbers then had not reached the technical excellence of the modern expert in dealing with extremely difficult ground, they had little to learn in the wider aspects of the craft, such as route-finding in unknown country, expedition planning, and the feel of mountain country. It was their skill in these matters, coupled with simplicity and hardihood of approach to the problems, that enabled Moore and his companions to accomplish such a prodigious amount in a short time. One is apt sometimes to belittle their achievements in the light of modern standards, but only those who have climbed and explored in unknown mountains can realize how much greater each difficulty and problem is for the pioneer than for any party that follows. There will undoubtedly come a generation of mountaineers which will laugh at our own flounderings in the Himalaya.

The fact that Moore wrote the book without any intention of publication makes it a work of rare charm, in which the personality of the author is vividly shown to the reader. It is good that so much detail which might have been thought unimportant has been retained. The editor's notes are helpful and concise, and do not interfere with the text. Moore's original sketch-maps are in the present edition, which is otherwise illustrated by photographs relevant to the country. Unfortunately the photogravure process used is not suitable for high mountain scenery. Mountaineers and all who like reading about mountains will be grateful for this inexpensive new edition. E. E. S.

A WAYFARER IN YUGOSLAVIA. By LOVETT FIELDING EDWARDS. *London: Methuen*, 1939. 7½×5 *inches;* xiv+272 *pages; illustrations and map.* 8*s* 6*d*

Mr. Edwards gets into his stride slowly, perhaps because the first part of his book is devoted to Dalmatia. The wayfarer is bound to be interested in the more important places, which have lost their bloom, and the scope of the book does not allow the author to deal at length with those which are less known. In the course of his wanderings from Sušak to Dubrovnik however he mentions a visit to Obrovac, and the coral fisheries at Zlarin; he is good on the island of Vis, and there is a felicitous reference to Leucas. At Dubrovnik the author begins to wake up, inspired as much by its historical and literary associations, of which he is qualified to speak, as by its site. Many however will find the most

interesting his chapters on the Neretva valley, describing the transition from Dalmatia to Moslem Bosnia and Sarajevo, and on the journey through the forest country from Sarajevo by way of Travnik and Jajce towards Zagreb. There is a pleasant chapter on Zagreb, the cultural capital of the country, a chapter on Slovenia, and one on Belgrade, before the author went south to Peć to take leave of the country. The bibliography is brief, but quite useful. The appeal of the book is a little uncertain: personal incidents do not always harmonize with fragments of literary history and archaeology. Mr. Edwards confesses he is no geologist, and he is not a geographer. Therein perhaps lies the reason for his failure to give a satisfying picture of the country and the way its peoples live, for he passes over phenomena that will strike the traveller most forcibly before ever he enter castle or monastery. His book may however stimulate the casual visitor to deeper interest. J. P. H. M.

ASIA

THE ANTIQUITIES OF SOUTH ARABIA: being a translation from the Arabic . . . of the Eighth Book of Al-Hamdāni's al-Iklīl . . . by NABIH AMIN FARIS. (Princeton Oriental Texts. Vol. III.) *Princeton: Princeton University Press—London: Oxford University Press*, 1938. 9×6 *inches;* 120 *pages; facsimile MS.* 11*s* 6*d*

Al-Hamdāni was an Arab of the Yemen who in the tenth century of our era compiled an encyclopaedia of South-Arabian antiquities and folk-lore. Of the original ten volumes, four are now known to be extant, but only the eighth, which deals with the ancient castles, dams, and tombs, has been edited as yet. The book under review is a translation of this volume, based on the printed edition and two additional MSS. now in the United States, both (judging from the variants cited in the footnotes) much inferior to the edited text. The translation is reasonably faithful, thanks largely to the linguistic notes of the original editor, whose work the translator ungraciously depreciates; his own "emendations" are sometimes far from happy. The greater part of the poetic citations he has omitted, quite justifiably; what he has retained would have been better translated into plain prose. It is difficult to assess the proportions of fact and fable in this volume, but amongst the mass of legend there is certainly preserved much material of value for the ancient history of the peninsula. The translator has supplied references to parallel passages and some historical notes; useful as these are, the book would be more intelligible to non-Orientalists if it had been furnished with some geographical commentary and a more adequate map. H. A. R. G.

REPORTS FROM THE SCIENTIFIC EXPEDITION TO THE NORTH-western provinces of China under the leadership of Sven Hedin—the Sino-Swedish Expedition—Publications [2] and 3. *Stockholm: Bokförlags Aktiebolaget Thule*, 1937–1938. 11½×9 *inches.* III. Geology. 1. Geology of western Quruq Tagh, Eastern T'ien Shan; by ERIK NORIN. xvi, 194+xliii *pages.* III. Geology. 2. Notes on some late palaeozoic localities in the Nan-Shan Se of Tun-Huang; by BIRGER BOHLIN. 54 *pages; illustrations and maps.* $13.50, 5

In the first of these volumes Erik Norin gives the results of his geological explorations in the Quruq Tagh ranges in the years 1928–30. It is a work of outstanding value to all who are interested in the structure of central Asia. Norin made many interesting discoveries; he has written a careful and objective

report which is illustrated with excellent geological maps (though the scale is incorrectly indicated), geological sections, and a fine series of photographs.

Suess has shown how an old fold system, called by him the Altaides and by later writers Hercynian, can be traced across Europe and Asia, through the Altai, Tien Shan and Kunlun. Argand [1] interpreted the present central Asian ranges as the surface expression of "plis de fond" produced in these previously folded regions of the crust during the Alpine earth movements. In his synthesis he introduced the idea of a relatively rigid mass, probably an ancient land mass, which he called Serindia. The present Tarim basin is supposed to represent this Serindian mass. The Quruq Tagh is the southernmost of the Tien Shan ranges bordering the Tarim basin, and it might thus yield decisive evidence concerning the relation of the Tien Shan ranges to the Tarim basin.

Norin obtained much important evidence bearing on these questions. In the metamorphic rocks at the base of the visible rock succession he found altered charnockitic gneisses. Such rocks are probably formed at considerable depth, yet these were bared by erosion and formed part of a land surface in Pre-Cambrian times; they are probably Archaean.

This old land surface was covered by a thick sedimentary and volcanic series, which included a group over 2000 feet thick of sandy and muddy sediments throughout which blocks and fragments of many kinds of rocks are haphazardly distributed. Some blocks seen were over 5 feet long; a few were striated. A series of varved shales associated with the boulder-bearing beds closely resemble those which were formed during the recent ice-age. Thin sections of the matrix of the boulder-bed show the flocculation structure characteristic of deposits dropped into sea-water from ice. Norin concludes that the boulders were carried by icebergs and were dropped as the bergs melted. Considerable glaciers or an ice-sheet must have occupied a not far distant region.

In rocks higher in the sequence, Norin found Upper Cambrian and Ordovician fossils. The glacial beds are therefore of late Pre-Cambrian or Cambrian age. This is particularly interesting as glacial beds of about this age have been found in Greenland, north Norway, Siberia, China, Australia, South Africa, and elsewhere, suggesting one or more periods of world-wide refrigeration. Remnants of Carboniferous and Jurassic formations have been found in the Quruq Tagh; later continental deposits, especially the Gobi Series, are widespread but are not described in detail in this report.

Much work is still needed to elucidate the structure of the western Quruq Tagh. It is shown that very recent block faulting has tilted peneplains and largely influenced the present topography. It is interesting to learn that the Hercynian structures trend nearly E.–W., not parallel to the margin of the Tarim basin. The extent and direction of thrusting remain uncertain, but the deformation of the Palaeozoic rocks is less intense nearer to the Tarim basin. The isolated Charchaq ridge, structurally part of the Tarim basin, is a scarp of little-deformed Cambrian and Ordovician rocks which dip gently in towards the basin. Taken as a whole the evidence is consistent with the theory that the Tarim basin is an old land mass, though comparison with such an area as the Kuznetzk basin in Siberia suggests that this is not the only possible theory to account for the structure. Norin, while avoiding speculation, is evidently attracted by the theories of Argand.

The scope of the second volume is indicated in the title; it is an account of the field relations of late Palaeozoic rocks seen on a N.–S. traverse of the Nan

[1] Thirteenth International Geological Congress 1924, Comptes Rendus, Pt. I, pp. 171–372 and map.

Shan ranges. It will be of greater value when the fossils which were collected have been described. From his observations the author concludes that in the region he traversed, the late Palaeozoic (Visean and later) sediments were deposited on the eroded folds of older rocks (probably largely older Palaeozoic); these old rocks are traversed by granites. It is clear from the diagrams and field-sketches that the late Palaeozoic rocks are also often sharply though irregularly folded. This deformation however is interpreted as the result of block faulting; the dominant trend of this faulting is W.N.W.–E.S.E., parallel to the principal ridges of the present Nan Shan mountain system. R. M. S.

AFRICA

EAST AFRICA AND ITS INVADERS, from the earliest times to the death of Seyyid Said in 1856. By R. COUPLAND. *Oxford: Clarendon Press*, 1938. 9 × 5½ *inches;* 584 *pages; maps.* 30*s*

The title Professor Coupland has chosen for this volume is significant, though it might with more justification have been 'The invaders of East Africa.' During the period covered little is known of the native peoples of East Africa, for research into this subject is only beginning. Until very recent times peoples from the outer world merely occupied, to a varying degree of effectiveness, the East African littoral. The Arabs, the most successful invaders prior to the nineteenth-century European arrivals, traded with the immediately adjacent interior, but, except during the later years of Seyyid Said's rule, made no attempt to penetrate inland. In discussing the history of the Arabs in West and East Africa, the most striking contrast is this failure of Islamic culture to spread as widely in the east as in the west. Two reasons may be suggested: in the east there is no adjacent area strictly comparable with the western Sudan, and in addition there was no incentive to penetration as powerful as the gold traffic of the upper Niger. It is incidentally an error to state that the Portuguese were the first to trade in slaves in West Africa.

In the historical narrative which the author unfolds therefore East Africa must be regarded as a marginal territory of the Indian Ocean rather than as an integral part of the African continent. With the spread of European rivalries to the East, the area enters international affairs, and the documentary evidence becomes abundant. Seventy-two pages suffice to carry this history to the year 1740: the remainder of the volumes is required to detail the events of the following century. The author has had therefore to deal with Anglo-French rivalry in the Indian Ocean through the Napoleonic period into the nineteenth century, but the link which closely bound East Africa to world politics was the establishment of Omani rule at Zanzibar by Seyyid Said, and the increasing prominence of the slavery question. Britain, however eager to abolish it, could not afford to estrange Seyyid, and thus upset the political balance in the Persian Gulf; Seyyid, resenting interference with a profitable traffic, was never strong enough to defy the British, while the French, resolved to secure coloured labour for their colonies in Réunion and elsewhere, drew what profit they could from this situation. Thus abolition was a long and chequered process, and Captain Owen's solution of the problem by the establishment of a protectorate at Zanzibar from 1823 to 1826 was rejected, only to be adopted nearly seventy years later.

Professor Coupland tells the latter part of the story in great detail, reinforced by copious quotations from documents in the India Office and the Public Record Office; it is unlikely that his book will be superseded as the authoritative history of East Africa from this aspect. G. R. C.

THE SOUTHERN BANTU. By L. MARQUARD and T. G. STANDING. *London: Oxford University Press*, 1939. $7\frac{1}{2} \times 5$ *inches;* viii + 262 *pages; maps.* 7*s* 6*d*

From its title one might expect this work to be one of the detailed sociological studies of the congeries of native people known as the Bantu, which have of late added much to our knowledge of their way of life and their mental processes. It is however more than that, for although the book opens with four chapters which give in non-technical language a concise account of the social organization of the tribes concerned, it then goes on to describe in detail the legislation in the various parts of South Africa which directly affects the native and is a result of European domination of the country. Facts are also given regarding the earning capacity of those who have come on to a cash subsistence basis, their living costs, and other aspects of Bantu life, many of which give food for criticism and which result from the increasing drift towards urban life.

The authors content themselves with stating facts, leaving the reader to draw his own conclusions. They have provided a quarry from which, if rulers so desire, the material for a sounder policy of race-relationship can be drawn. It is of little use to bewail the disintegrating effect of the contact of the white and black which is so patent to all observers. It is a fact, and the momentum of the breakdown of tribal institutions is increasing. When we realize that seven million natives south of the Zambezi and nearly twenty millions north of the Zambezi on the eastern side of Africa are involved in these forces of change, the magnitude of the problem must become apparent. The governments concerned are year by year becoming impressed with the necessity of promoting better understanding, but in some regions public opinion still tends to be reactionary. Such an attitude must however be modified, and the work of the South African Institute of Race Relations deserves every support, for its aims are, apart from research, to stimulate a healthy and informed public interest in questions affecting racial contact.

The work under review, with its dispassionate record of facts, should be of great help to those who approach the question with an open mind and a desire, by influencing public opinion, to better the lot of the black races of Africa. Long views are needed; these cannot be formulated hurriedly and their execution will need wide support, and maybe sacrifice, from both black and white.

C. W. H.

DUMINY—DAGBOEKE. Diaries of JOHANNA MARGARETA and FRANÇOIS REINIER DUMINY. Edited by J. L. M. FRANKEN. *Kaapstad: Van Riebeeck-Vereniging*, 1938. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 356 *pages; illustrations and route-maps.* 13*s* 6*d*

The Van Riebeeck Society has recently issued its nineteenth volume, consisting of the three surviving fragments of the Duminy Diaries which have been edited in a most scholarly manner by Professor J. L. M. Franken, of the University of Stellenbosch. Each fragment, the first in Dutch and the other two in French, is preceded by an introduction in Afrikaans and followed by an English translation, while all are well illustrated by contemporary portraits, facsimiles, maps, and by a modern map. Further relevant documents are given in the appendices.

The first fragment is from the diary of Johanna, wife of the French ex-naval officer, the Chevalier François Duminy of Lorient in Brittany. It tells of the daily round of farm life and of a journey to the hot springs at Caledon in 1797, and thus forms a supplement to the better-known 'Letters' of Lady Anne Barnard. It is of interest to philologists, for its Dutch shows clear traces of the spoken Afrikaans more than a hundred years before that tongue became a

literary language. The second fragment is from the diary of the Chevalier himself. Written in French, it forms a sequel to the first, recording a journey to the Baths during the early years of the second British occupation. It ends with a letter of sympathy to the last French Governor of Mauritius, then at Capetown on his way home to France, after the capture of his island by the British. The third fragment, also in French, is again from François Duminy's diary. It covers the early months of 1793, when, as an officer of the moribund Dutch East India Company, he journeyed up the coast of South-West Africa. visiting some of the Guano islands and taking possession of Walvisch Bay, hoping to find gold and fully intending to control the whaling and sealing in the interests of his employers. The gaps in this diary are partly filled in by extracts (in an English translation) from the diary of Sebastiaan van Reenen, Duminy's fellow traveller.

Taken together, these three fragments give a valuable picture of social life in the western Cape Colony of those days, with something of the politics and the journeying far afield that have never been long absent from that life.

E. A. W.

NORTH AMERICA

AN EYE-WITNESS OF MEXICO. By R. H. K. MARETT. *London: Oxford University Press*, 1939. 8×5½ *inches;* xii+268 *pages; illustrations.* 8*s* 6*d*

Mr. Marett has written a book which presents the best picture of modern conditions in Mexico to appear for a long time. It does not purport but proves to be much more than a series of records of his life, during seven years, as an employee of one of the great railroads, as a business adventurer in mining and real estate, and as an official of the Mexican Eagle Oil Company on the Isthmus of Tehuantepec. To these economic experiences he added work as an amateur archaeologist and the publication of an excellent and well-appreciated guide to Mexican archaeological sites. He also made visits to the Laguna cotton country and, when he married into an old family of Mexico, to one of the few then remaining haciendas of a feudal type.

In consequence of this variety of contacts the author became acquainted with not only a considerable proportion of Mexican territory, but perhaps an even larger proportion of Mexican economic affairs. His observations are recounted in a straightforward and lucid manner for which one may well be grateful; and to honesty are added sympathy and appreciation of broad problems.

The typography is excellent; map and index are adequate; and several of the illustrations are first class.

L. E. J.

CENTRAL AND SOUTH AMERICA

FEVER, FAMINE, AND GOLD. By Captain E. ERSKINE LOCH. *London: William Heinemann*, [1939]. 9×5½ *inches;* xiv+264 *pages; illustrations and route-map.* 12*s* 6*d*

This is one of the books on South America which recount desperate travail, sufferings, fears, and hopes, with a motive not made altogether clear.

Captain Loch suggests in his introduction that he had acquired the idea that a navigable waterway might be found from easterly Ecuador to the Peruvian frontier; he thought that the river Curaray might offer a new route. His pages however supply no reason for supposing that an addition to the existing route, by way of the Napo river from Quito, is needed. One cannot ignore the practical questions of supply and demand; few regions of South America could offer

less interest in either. The author's descriptions of climate and conditions are not encouraging; and, even according to his own account, he did not find a way to the Curaray headwaters *via* the Llanganati mountains.

His attention seems to have been diverted by stories of gold treasure, prevalent in Peru and Ecuador. Legends of vast quantities of gold hidden by faithful Incas after the murder of their ruler Atahualpa have been prevalent for centuries; but it is difficult to understand how any one can consider seriously the existence of "a" treasure; it is highly unlikely that Pizarro missed much, even if any quantity were still moving towards Cajamarca when the news of the murder became known. It must be remembered that neither Ecuador and Peru in particular, nor South American countries in general, are great gold-producers. The ornaments collected by the Inca aristocracy made a great show in Spanish eyes simply because they were practically all in a few hands; being imperishable, this gold represented the work of generations. Stories of the hidden treasure—the Peje Chico and Peje Grande, Little Fish and Big Fish, of which Captain Loch does not seem to have heard—still persist; the location indicated is generally on the top of an inaccessible mountain or in a bottomless swamp. The author was spurred by Valverde's well-known directions (detailed in a paper by Richard Spruce given to the Royal Geographical Society in 1860 *Journal R.G.S.* 31 (1861) 163–84), and hunted in the wrong season, and at the cost of much suffering for both himself and his helpers, in regions of high altitude where, even at the best, cold and damp prevail. No cache was found; but eventually the author heard of, and is apparently developing, gold deposits on the Napo river.

The author is able to claim, as scientific results of his various journeys, surveys of hitherto uncharted country in easterly Ecuador; and collection of natural history specimens now enriching museums, chiefly in the United States. Many photographs are of considerable interest; maps are inadequate; spelling of Spanish words is apparently the author's own concept. An outstanding example is "haciendiero" for the owner of a farm in Ecuador. L. E. J.

AUSTRALASIA AND PACIFIC

THE GEOGRAPHY OF THE FIJI ISLANDS. By R. A. Derrick. *Davuilevu (Viti Levu): Technical School*, 1938. 10×7 *inches;* 184 *pages; illustrations and maps*

This is a most interesting book, not chiefly for its treatment of Fiji, but rather for its genesis and its form: the whole of it, with the exception of four maps, was produced in the Davuilevu Technical School. It was written by the headmaster, and printed and bound by Fijian students under the supervision of their instructors. Given the limitations imposed by the media (the multigraph machine for printing and lino-cuts for the illustrations), the result is very creditable and speaks well for the methods of education and the standard of work in the school. Both text and diagrams however are a little difficult to get accustomed to, and will probably not add to the popularity of the book. The geography shows inevitably the lack of balance in the material available. The physical basis is well done, both in the general section and again in more detail for particular islands. Strangely enough the climate is not dealt with until the very end of the long physical section. The human aspects, under the title "Political," are dismissed in a mere 13 pages out of a total of 175—a great opportunity lost. One appendix gives a list of the 265 named islands, ranking the first 50 in size. A second gives a useful summary of the chief theories of

coral atolls. Here for the first time English teachers have available for reference, within the limits indicated above, a really detailed treatment of the Fijian Islands.

R. O. B.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

FINNISCHES GEODÄTISCHES INSTITUT 1918–1938. Veröff: des Finn. Geod. Inst. No. 26. *Helsinki:* 1939. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches; 128 pages; illustrations and maps*

Amongst the geodetic institutes of the world—and not every one of the foremost countries has one—that of Finland must be accorded a high place. In the course of the twenty-one years of its existence it has published twenty-six reports and treatises not only in a form pleasant to read and handle but with a content of real value to the student of geodesy. Much of the success and renown enjoyed by the Institute is due to Toivo Ilmari Bonsdorff, its organizer and Director from the start, and its most recent publication is dedicated to him on the occasion of his sixtieth birthday. It gives a résumé, which could hardly be bettered, of the whole of the scientific activities of the Institute since its foundation. The career of Professor Bonsdorff himself is sketched by the friendly hand of W. Heiskanen, who was for seven years on his staff. The foundation of Bonsdorff's success as geodesist and administrator was laid by a well-balanced training. At the age of twenty-one he was already taking part in gravity observations and was shortly afterwards engaged in field astronomical work. Then followed fifteen years at Pulkovo, in the course of which he carried out a varied programme of work, principally astronomical perhaps but including the greater part of the computations and adjustment of the Spitsbergen Arc of Meridian, and field work in base measurement, precise levelling, and astronomy. It is thus not surprising that there has grown up around him in the Institute a school of geodesy which has reached out into almost every domain of the subject.

The greater part of the book deals with the various activities of the Institute, each in a concise essay by the appropriate expert and each with a useful list of references to original papers. Some interesting historical matter reveals both the connection of Finland with some of the classical operations of European geodesy and the difficulties with which Finnish geodesy had to contend until a more settled political situation at last rendered possible the creation of the Geodetic Institute in 1918. There are contributions by two well-known geodesists outside Finland. Professor Eggert has written on the Baltic Geodetic Commission and its work, and Dr. Bowie on cooperation in international science. Professor Bonsdorff himself fathered the Baltic Geodetic Commission and persuaded his Government to invite the Baltic countries to send delegates to the first conference in Helsinki in June 1924. This and the succeeding conferences (the tenth was held at Kaunas in June 1938) have achieved real international cooperation and have appreciably enriched the literature of geodesy. Its Reports and Special Publications, in the same convenient format as those of the Finnish Geodetic Institute, have appeared with commendable promptitude from Helsinki.

If any further remark about the Institute itself is appropriate here, it is to agree with Professor Heiskanen that, though young, it did not always accept unchallenged the ideas, whether of practical or theoretical geodesy, which it found current abroad. Rather did it encourage its staff to see merit in the development of new methods of observation and calculation. Mr. Väisälä's application of the interference of light waves to base measurement and Mr. Ölander's evaluation of the use of Laplace points in the adjustment of triangulation are notable cases in point.

H. L. P. J.

ECONOMIC AND HISTORICAL GEOGRAPHY

DIE GEOGRAPHIE DES MENSCHEN (ANTHROPOGEOGRAPHIE). By HUGO HASSINGER. (Handbuch der geographischen Wissenschaft. Edited by FRITZ KLUTE. Allgemeine Geographie. II. Pp. 167–558.) *Potsdam: Akademische Verlagsgesellschaft "Athenaion,"* [1938 ?]. 12×9½ *inches; illustrations and maps*

This section of the *Handbuch* proceeds on lines familiar to those acquainted with works in German on general geography. First there is a long and involved discussion of the content of human geography and its relation to kindred sciences. This is followed by the treatment of the subject in accord with a rigid classification which removes a good deal of its vitality, despite the inclusion of examples drawn from all parts of the world. The author's subject-matter displays little that is novel, but it has been compiled conscientiously and comprehensively. He considers the relations of man to the earth in three categories: man and his works as items in the individual region; man, up to a certain stage of development, as a product of the soil; and man as the transformer of his environment through the requirements of his daily life, the development of civilization, and the potentialities of the group of mankind to which he belongs. It will be seen that the author avoids attributing absolute determining influence to the environment, and attaches a good deal of importance to the time factor and to cultural contacts. Elsewhere he agrees that there is no certainty of environmental influence on race, though he sees a general relationship between physical character and natural region.

The drawback to a work on this system is that it tends to develop into a descriptive list of phenomena, with loss of the underlying unity, as is seen in the treatment of the question of settlement; and the section on synthetic anthropogeography scarcely provides a general view of the whole. It is curious too to find in the section on "the phenomena of man in the landscape" that the principal subject treated is clothing. No doubt to complete his scheme the author felt obliged to give a good deal of space to the physical characteristics of man and their development, but much of this must lie outside the scope of the geographical student. G. R. C.

THE REFUGEE PROBLEM: report of a survey. By Sir JOHN HOPE SIMPSON. Issued under the auspices of the Royal Institute of International Affairs. *London: Oxford University Press*, 1939. 8½×5½ *inches;* xvi+638 *pages; maps.* 25*s*

This volume is one of the reliable compendiums of available information for which the R.I.I.A. is known; and it adds to the debt which all students of affairs owe to that body. It is concerned only with those refugees who have left European countries, including in that term those of the former Russian and Ottoman Empires, since 1918. These population movements have led to some important redistributions. It is noteworthy that where there has been exchange, as between Greece and Turkey, the ethnographic or linguistic boundaries have now become almost identical with the political boundaries; and minority problems have vanished. In some other cases such problems have been reduced. Elsewhere, however minorities have been increased, as is the case of Russians in some of the Baltic States. There is a full statement of facts about the movements of the Jews. The geographer will find here much well-documented material for the necessary revision of our knowledge of the distribution of peoples over a wide area. C. B. F.

THE MONTHLY RECORD

ANOTHER MS. COUNTY MAP BY WILLIAM SMITH, 1599

Any small sidelight on the early history of English topography has a certain interest, and one such is the recent finding of an undescribed map of Staffordshire, dated 1599, by William Smith, Rouge Dragon (known for various writings, mostly unpublished, connected with topography and genealogy in the reign of Elizabeth), which has been acquired by the William Salt Library at Stafford. Through the courtesy of the Librarian, Miss H. L. E. Garbett, we have obtained a photograph of the map to add to the Map Room Collection. Dating from some quarter of a century after Saxton's great achievement, its importance in the story is but secondary, and its interest lies chiefly in the question how far Smith may have been concerned in the publication, about 1602–03, of the anonymous series of county maps of which the Society possesses seven original issues, and of which the genesis is still obscure. Smith's work in the field of topography included his 'Description and map of Cheshire' (1585) and his 'Particular description of England' (1588), but he also drew a map of Lancashire (1598), preserved in MS. at the British Museum. Both the Cheshire and Lancashire had an evident influence on the anonymous maps of those counties (and through them on Speed's), and the same is now found to hold good for the Staffordshire, with which the printed versions are in very close agreement.

Miss Garbett has kindly sent some notes on the MS., written by Smith in 1597, in which the map occurs; being on different paper and dated two years later than the rest, it was not a part of the original documents. The bulk of the MS. is a copy of the "visitation" of the county made in 1583 by Robert Glover, Somerset Herald, himself responsible for the earliest known attempt at a county map—that of Kent lately described by Canon Livett (*Geogr. J.* 92 (1938) 158). Smith says he transcribed the visitation in 1597; it is not however a mere copy, but contains notes and additions (mostly in red ink, some signed W. S.) which carry on the story to 1603 at least. The map is unsigned, but a careful comparison with Smith's Lancashire at the British Museum by Mr. Lynam leaves little doubt that it is in his autograph.

It is difficult to be sure of the precise purpose of Smith in drawing these county maps: whether he professed to improve on Saxton's, which of course supplied his basis, is not clear. The outlines seem to have been rather roughly copied from Saxton's, the courses of the rivers and other lines being generally smoothed out to some extent as if merely drawn in by eye. The MS. containing the Lancashire is again the transcript, made in 1598, of a previous visitation, and all three maps differ in detail from Saxton's, particularly in the spellings of names. It seems most likely that they were intended, primarily at least, merely to illustrate the documents they accompanied (and this is borne out by the insertion in the Staffordshire of the names of the principal families represented in a large number of the places marked). It is singular however that they should have been so closely copied in the anonymous series and, through this apparently, by Speed, though in neither printed version are all Smith's names included, and errors are sometimes introduced, as when Drayton Bassett becomes Braiton in print, though given correctly by Speed in the list on the back of his map. As the anonymous maps of the three counties are undated, it might be asked whether they may not have appeared before 1600 and been used by Smith, rather than *vice versa*. This seems hardly likely, perhaps, in view of Smith's interest in British topography at least thirty years earlier (his plan of Bristol was made in 1568), while his Cheshire MSS. were written very soon after

his return from Nürnberg,[1] and must have been based on material collected before he went abroad (about 1578). Being a native of Cheshire, he would naturally have special facilities for dealing with that county, and his help is specially acknowledged by Speed as regards his own map of Cheshire. E. H.

BALTIC GEODETIC COMMISSION

The tenth conference of the Baltic Geodetic Commission took place in Kaunas, Lithuania, in June 1938. The transactions of this meeting ('Verhandlungen der zehnten Tagung der Baltischen Geodätischen Kommission') occupy 141 pages, for the most part in German, and are concerned with geodetic and geophysical work round the shores of the Baltic. The countries represented are Denmark, Esthonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden; and among the guests invited by the president to take part in the conference were representatives of Great Britain, France, and Norway.

The reports of the various committees include a communication by Seidel on levelling in the Baltic, and another by V. R. Ölander on the work of coordinating the *Ostseering*. The committee for the measurement of gravity announces new connections with Potsdam, and also a projected gravity survey in a submarine using a Vening Meinesz pendulum apparatus. There then follows the report of the secretary-general, after which come the *Landesberichte*. For Germany O. Eggert and Seidel describe the work of the Geodetic Institute and of the Reichsamt für Landesaufnahme, and mention is made of gravity measurements with pendulums and static gravimeters, some of the latter being carried out on a surface vessel on the Elbe. N. E. Nörlund gives a short account of work in Denmark, and E. Ahman describes what has been done in Esthonia. For Finland I. Bonsdorff deals with triangulation, the measurement of base lines, astronomical observations, gravity measurements, and precise levelling. E. Warchalowski, reporting for Poland, includes a map of his country showing the position of precise levelling reached by 1 January 1938.

Papers by five authors are presented. A. Krikščiūnas writes of the history of geodesy and cartography in Lithuania from the time of the first map of the country in 1507 up to the present day. W. Heiskanen gives an account of some new isostatic investigations. A paper by Seidel discusses the connection between the levelling systems of Germany and Denmark; and a mathematical treatise by I. Bonsdorff is concerned with the determination of weighting factors when differences only are observed. Finally, R. A. Hirvonen describes the practical application of the spheroidal mid-latitude formulae. A. E. B.

THE IRAN–'IRAQ BOUNDARY TREATY, 1937

The text of the Iran–'Iraq Boundary Treaty of July 1937 was printed in the *Oriente Moderno* for September 1937, having been taken from the *Journal de Téhéran* for 20 July 1937. The dispute over the Shatt al 'Arab, which is of some general interest for international law, concerned the claim of Iran that the frontier should run *medium filum aquae*, whereas the Government of 'Iraq claimed the left bank of the river (low-water level). The latter claim was held to have been admitted in the Treaty of Erzerum with Turkey in 1847. Practically it meant that Persian (Iranian) vessels navigating from or to Mohammerah (now Khurramshahr) would be in foreign waters, and subject to dues and regulations of the Turkish (or later 'Iraq) Government, exercised through the port of Basra. An agreement with Turkey in 1913 confirmed these arrangements, but declared

[1] Mr. Parsons, Keeper of Maps at the Bodleian, has kindly sent drawings of the watermarks on the Cheshire MSS. preserved there which show that they were written on German and French paper (the maps on the former), no doubt procured at Nürnberg. The Cheshire map at the British Museum seems a later copy by another hand.

the navigation of the Shatt al 'Arab to be international, and a commission composed of Turkish, Persian, British, and Russian representatives was set up to arrange practical details and fix the frontiers. This commission, which began to function in December 1913, gave the left bank to Turkey.

However in December 1934 the Iranian Government complained about the unsatisfactory working of the agreement under the Basra port authorities, and demanded that the boundary should follow the *thalweg* (*medium filum aquae*). The 'Iraq Government insisted on its claim to the east bank.

The dispute was satisfactorily settled between the two parties by the treaty signed at Tehran on 4 July 1937. It confirms the agreement of November 1913 with Turkey, except as modified in the second article of the 1937 treaty. By this the old boundary is confirmed as far as "the most advanced point of the Island of Shoteit (Shutait)" in lat. 30° 17′ 25″ N., long. 48° 19′ 28″ E. From there a line perpendicular to the low-water level (left bank) joins the middle of the Shatt al 'Arab, and follows it to a point opposite No. 1 Jetty of Abadan in 30° 20′ 8·4″ N., 48° 16′ 13″ E., whence it rejoins the low-water-line frontier of 1914. A commission is to be set up to fix the boundary marks as considered necessary.

Other articles declare that the Shatt al'Arab is to remain open for all merchant vessels, and for war-vessels of the two parties. Charges, etc., are to be used exclusively for costs of upkeep, amelioration, and sanitation. Pending the completion of the work of the commission, the 'Iraq Government will regulate such matters, keeping the Iran Government informed of measures taken and expenses. A regular convention on such matters is to be subsequently concluded between the two parties. It is expressly stated that the fact that the boundary follows now the "*medium filum aquae*" and now the low-water limit does not prejudice the right of either to the use of the whole course of the river. With regard to foreign warships, a protocol states that either party may give leave of entry, informing the other. The same protocol states that nothing in the treaty is to prejudice the rights and obligations of 'Iraq under the treaty with Great Britain of June 1930.

The arrangement seems to have provided an effective compromise under which Iran secures practical rights of navigation of the Shatt al 'Arab on equal terms with 'Iraq, together with sovereignty over the waters immediately facing the port of Abadan. A. S. E.-S.

DUST-STORMS IN 'IRAQ

Mr. F. E. Coles discusses the meteorological circumstances of dust-storms in 'Iraq in *Professional Notes* No. 84 of the Meteorological Office (1938). As a result of the desert character of 'Iraq the air, up to 15,000 feet above the ground, may be filled with sand or dust particles raised by the wind. The sand particles are very small and penetrating, so that the sand-storms are generally called dust-storms. The criterion used to define a dust-storm is an obscuration due to sand or dust with a wind of Beaufort Force 4 or over, causing a decrease of visibility to below 1100 yards. The wall of sand so often associated with Egyptian sand-storms or *haboobs* is relatively infrequent in 'Iraq. The first sign of a dust-storm in 'Iraq is often an abnormal glare round the sun; then the dust may be seen to be rising in patches from the ground with progressive reduction of visibility, which in very severe cases may be less than 20 yards. During the rainless summer months dust-storms occur during the day with strong north-west winds locally known as *shamal*, but during the winter they come with *fronts* and thunderstorms sometimes at night, and, as the reduction of visibility is sudden, the winter type is the more dangerous.

The periods of maximum frequency and severity of dust-storms are May and

October in northern 'Iraq, March to May in central, and June and July in southern 'Iraq. In the west the hard rocky nature of the higher ground greatly reduces the frequency of dust, and over the whole of the country the dust-storms are infrequent between November and February, when the rainfall is greatest. One of the chief meteorological factors in dust-storm development appears to be turbulence or eddy-motion in a descending current of air which, in impinging on the surface, scrapes up the sand. This is then carried aloft by eddies when the current is sufficiently strong. The process is described as probably analogous to that of a stone dropped into a pool of water, the detachment of water drops as spray being similar to the detachment and raising of sand particles. A photograph taken from the air shows the advance of a dust-storm near Samarra in 1936, with details of its structure.

REVISION OF THE AIR ALMANAC FOR 1939

The first edition of this Almanac appeared for the last quarter of 1937 and consisted of two parts, a permanent portion and auxiliary tables. The 1939 edition (which was the subject of a discussion published in the *Journal* for August 1938) is in one part and, while retaining the main features of the earlier editions, has been revised in several respects. The intervals of tabulation have been decreased, thus making the necessary interpolations speedier, and a single page now contains all the data for one day. These pages can be torn out to current date. Tables of Sunrise, Sunset, Moonrise, and Moonset have been added. The ingenuity in the arrangement of the interpolation folder, together with a generally improved lay-out, makes for greater ease and rapidity in use.

OBITUARY

PROFESSOR A. P. COLEMAN, F.R.S.

Dr. A. P. Coleman, whose death took place on February 26 at Toronto, was not only a distinguished Canadian geologist and geographer, but a man of wide tastes and accomplishments.

He was born at Lachute, Quebec, in 1852, and after earlier education at Victoria University, Cobourg, Canada, he took his Ph.D. degree at Breslau, Germany. After holding the Professorship of Geology and Natural History at Cobourg he was appointed to the Chair of Geology at Toronto University in 1890. He became Emeritus Professor in 1922. His many distinctions included the presidency of Section C, British Association, in 1910; presidency of the Royal Society of Canada in 1921, and of the Canadian Institute for two years. In 1910 he was awarded the Murchison Medal of the Geological Society of London, and in 1936 the Penrose Medal of the Geological Society of America. From our Society he received the Victoria Medal in 1932.

Coleman's geological studies were very extensive, and ranged from authoritative papers and treatises on ore deposits (particularly the great nickel field of Sudbury, Ontario) and Pre-Cambrian stratigraphy to palaeontology and Pleistocene geology. With Professor W. A. Parks, of Toronto University, he wrote 'Elementary geology: with special reference to Canada,' a well-illustrated book which is in use outside Canada also. He had an international reputation in glacial geology, and his work 'Ice ages: recent and ancient,' published in 1926, is characteristic of his clear and vivid style. Even as recently as 1934 and 1936 he was pursuing his glacial studies in South America and Mexico. He was an enthusiastic traveller, a water-colour painter, and something of a poet.

Coleman paid a first visit to Cambridge at the time of the Centenary Meeting of the British Association in London in 1931, and the writer will not easily

forget his almost boyish enthusiasm, whether at the experience of dining in a college hall or for such an architectural wonder as King's Chapel. Coleman was about to start on a further journey to British Guiana at the time of his death: he still seemed in perfect condition. And he had plans during this coming summer to visit Mount Coleman, in the Canadian Rockies.

He was a vigorous and keen mountaineer of the pioneering sort, and had carried out important explorations, and geological mapping, in the Canadian Rockies, in the mountains of northern Labrador on behalf of the Canadian Government, and extensively in northern Ontario and Quebec. His book 'The Canadian Rockies: new and old trails,' published in 1911, is a delightful account of pioneer work during twenty-five years in that region. He made one of the earliest attempts to ascend the difficult and highest peak of the range, Mount Robson; and in a water-colour sketch of his we have what is probably the earliest picture of Robson's great rival, Mount Waddington, in the Coast Range of British Columbia. He held Honorary Membership of the Alpine Club, the Alpine Club of Canada, the American Alpine Club, etc., and had been the second president of the Alpine Club of Canada from 1908 to 1914.

Coleman pursued his glacial and geological studies with avidity to the end. He was ever ready to defend orthodoxy and challenge in a kindly manner extravagant or loose thinking. To a recent controversial correspondence on "Antarctica and Glacial Ages" he contributed the following pertinent remarks in the course of a letter (see *Nature* 142 (1938) 999), perhaps the last he ever wrote to a scientific journal: "May an old-fashioned geologist ask the advocates of drifting continents how they account for the extraordinary performances they so readily assume? . . . These casual driftings of massive blocks of the earth's solid crust should have some reasonable explanation before being used to account for the distribution of plants and animals. The Gondwana plants are mainly ferns, equisetums and club-mosses, especially ferns—all cryptogams the spores of which could easily be transported by the wind. A gale would quickly carry them hundreds of miles. Why send continents crashing through the solid earth's crust to effect their distribution?" Coleman, with his wide knowledge of the earth and earth-science, was one whose opinion carried weight. The world of science has lost a great exponent of its lore, and many of us have lost a kindly friend.

N. E. O.

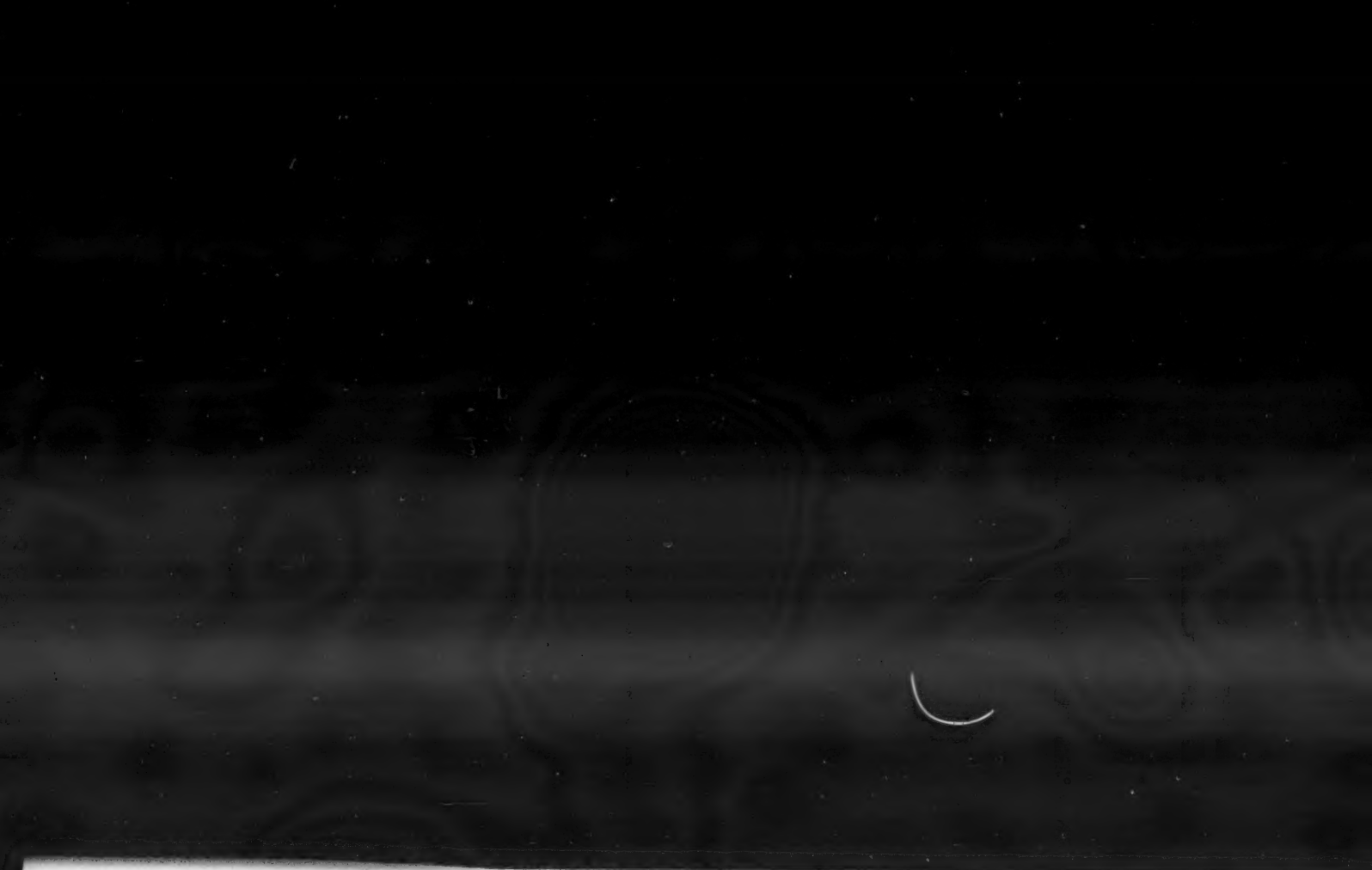
MEETINGS: SESSION 1938–39

Twelfth Evening Meeting, 24 April 1939. The President in the Chair

Elections: Peter Chrismas Davey; Kin Maung Latt, B.A.; George King, B.SC.; Lieut. Robert Fallowfield Kipling, R.N.; Sub-Lieut. Denis Handcock Mackay, R.N.; Fred H. Reid; George Taylor; Nigel Beaumont-Thomas; Hon. Mrs. J. Hanbury-Tracy; Cyril Ernest Tull; Reverend Ralph Gale Turnbull, M.A.

Paper: The Imperial College Expedition to Jan Mayen, 1938. By Mr. Alexander King

Thirteenth Evening Meeting, 8 May 1939. The President in the Chair

Elections: Kazi Saieduddin Ahmad, M.A.; Frank Baxter, F.N.G.S., M.I.T.A.; Dr. Albert M. Bender; Mrs. Margaret D. Bensusan, B.A.; Reverend Charles Bernard Cockett, M.A.; Peter Bruce Cornwall; Captain William Brandford Griffith; Miss Margaret Harrison; Arthur Wilfred King; Vincent Korda; William Baird McQuitty; Deric Nusbaum; Captain William Blacklock Rose; Adrian Gilbert Scadding; Captain Joseph Kenneth Shepheard, R.E.; Reverend Oswald Jeffrey Smith, D.D.; William Jackson Taylor, L.R.I.B.A., M.T.P.I.

Paper: Journeys in Arnhem Land. By Dr. Donald Thomson